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ABSTRACT

To provide a handy reference for those concerned with ways to avoid the further spread, or proliferation, of nuclear weapons, the House Committee on Foreign Affairs and the Senate Committee on Governmental Affairs have since 1977 sponsored periodic publication of the Nuclear Proliferation Factbook. This fourth edition of the factbook includes a wide selection of basic documents and national and international statistical data pertinent to the proliferation of nuclear weapons. Following an introduction, major sections focus on: (1) basic documents (selected documents which provide basic information on the foundation of the international nonproliferation regime and on the legislative and executive branch components of U.S. policy); (2) nuclear weapons; (3) routes to nuclear weapons; (4) the nuclear fuel cycle; (5) nuclear reactors; (6) uranium supply and demand; (7) fuel reprocessing and spent fuel management; (8) nuclear exports and assistance; (9) nuclear industrial bases in nonweapon states; (10) safeguards; and (11) the non-proliferation treaty review conferences. (JN)

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99th Congress
1st Session

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NUCLEAR PROLIFERATION FACTBOOK

PREPARED FOR THE

SUBCOMMITTEES ON ARMS CONTROL, INTERNATIONAL SECURITY AND SCIENCE

AND ON

INTERNATIONAL ECONOMIC POLICY AND TRADE

OF THE

COMMITTEE ON FOREIGN AFFAIRS
U.S. HOUSE OF REPRESENTATIVES

AND THE

SUBCOMMITTEE ON ENERGY, NUCLEAR PROLIFERATION, AND FEDERAL PROCESSES

OF THE

COMMITTEE ON GOVERNMENTAL AFFAIRS
U.S. SENATE

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FOREWORD

CONGRESS OF THE UNITED STATES,
Washington, DC, June 27, 1985.

As the 40th anniversary of the first, and hopefully the last, use of nuclear weapons draws near, we can be thankful that only five nations today have nuclear arsenals and only one other nation has tested a nuclear explosive. A world with more nuclear weapons states would certainly be more dangerous and would pose a greater threat to our national security and foreign policy interests. Nonetheless, many states are acquiring parts of the nuclear industrial base needed to produce the materials to make nuclear weapons. While some of these states have foresworn the acquisition of these dread weapons, others are ambiguous in their attitude, or appear to desire a capability to quickly make nuclear weapons. This expanding access to the technologies, facilities and materials of nuclear energy, as well as new technological developments, have made the task of guarding against their diversion to military purposes both more difficult and more important.

To provide a handy reference for those concerned with ways to avoid the further spread, or proliferation, of nuclear weapons, the House Committee on Foreign Affairs and the Senate Committee on Governmental Affairs have since 1977 sponsored periodic publication of the Nuclear Proliferation Factbook. Now in its fourth edition, this factbook collects in one volume many of the most essential documents and data relating to risks of proliferation, and to national and international means of avoiding it. The factbook has stood the test of time as a useful aid to decisionmakers responsible for the effectiveness of U.S. nonproliferation policies and their application. Past editions can be found in national and international agencies, universities, and public interest groups throughout the world.

This fourth edition was prepared by the Congressional Research Service of the Library of Congress at the request of the House Committee on Foreign Affairs and the Subcommittee on Energy, Nuclear Proliferation and Government Processes of the Senate Committee on Governmental Affairs.

As with previous editions, the committees are grateful to the Congressional Research Service, particularly Dr. Warren Donnelly and his staff, for their fine work in preparing this fourth volume. Of course, any views that might be inferred from the selection or content of the materials should not be considered as representing the views of the Committee on Foreign Affairs, the Committee on Governmental Affairs, or any of their members.

Dante B. Fascell,
Chairman, Committee on Foreign Affairs,
House of Representatives.

William V. Roth, Jr.,
Chairman, Committee on Governmental Affairs,
U.S. Senate.

LETTER OF SUMMITTAL

Congressional Research Service,
The Library of Congress,
Washington, DC, June 27, 1985.

Hon. Dante B. Fascell,
Chairman, Committee on Foreign Affairs, House of Representatives, Washington, DC.

Dear Mr. Chairman: I am submitting this fourth edition of the factbook on proliferation. It is the latest of a series begun at the request of this subcommittee in 1975.

Included in this factbook is a wide selection of basic documents and national and international statistical data pertinent to the proliferation of nuclear weapons. The factbook was prepared by Mark Martel, Office of Senior Specialists, and Carol A. Eberhard, now with the Office of International Programs of the Nuclear Regulatory Commission, under the supervision of Dr. Warren H. Donnelly, Senior Specialist.

We wish to express our continuing appreciation to Dr. Frank Blackaby, Director of the Stockholm International Peace Research Institute, for his kind permission to draw upon SIPRI publications, and also to the Ballinger Publishing Co., and the American Nuclear Society for allowing use of their materials in this factbook.

We hope that this fourth edition of the factbook will continue to serve your needs and those of the Congress generally.

Sincerely,

Gilbert Gude, *Director.*

CONTENTS

	Page
Foreword	v
Letter of submittal	vii
World proliferation map	x
Introduction	1
Basic documents	11
Nuclear weapons	267
Routes to nuclear weapons	299
The nuclear fuel cycle	313
Nuclear reactors	325
Uranium supply and demand	369
Uranium enrichment	385
Fuel reprocessing and spent fuel management	403
Nuclear exports and assistance	451
Nuclear industrial bases in nonweapons states	501
Safeguards	523
The Non-Proliferation Treaty Review Conferences	555

INTRODUCTION

I. Some History

The first nuclear weapon was exploded on July 16, 1945, near Alamogordo, New Mexico. The first use of a nuclear weapon in war came less than a month later at Hiroshima, Japan. Three days later, the second—and so far the last—nuclear weapon used in war fell on Nagasaki. The weapons used against Japan, while primitive by today's standards, killed over 100,000 people. U.S. efforts to prevent the further spread, or proliferation, of nuclear weapons began soon thereafter. In 1946 Ambassador Bernard Baruch, in an address to the newly established United Nations Atomic Energy Commission, proposed the establishment of international control over nuclear energy, to be followed by the disposal of the U.S. nuclear arsenal. Also in 1946 Congress passed the Atomic Energy Act, which ended the wartime collaboration of England and Canada in the U.S. nuclear weapons project and prohibited the export of almost all nuclear equipment, materials and technology.

The 1946 act reflected the prevailing view that rigorous denial of nuclear technology was the best way to avoid nuclear proliferation. These early efforts to prevent the spread of nuclear weapons failed, however. Disagreement between the United States and the Soviet Union over whether the United States should dispose of its arsenal *before* international control over nuclear energy was established (the Soviet position) or vice versa (the American position) prevented the adoption of the Baruch proposal; and the U.S. policy of denial did not prevent the development of nuclear weapons in other nations. In 1949 the United States lost its nuclear monopoly when the Soviet Union tested a nuclear device. The United Kingdom, France, and China followed suit in 1952, 1960, and 1964, respectively. All of these nations now have nuclear arsenals. The destructive power of nuclear arsenals took a quantum leap in the 1950's when both the United States and the Soviet Union tested and began production of hydrogen fusion weapons.

The early U.S. policy of secrecy and denial in nuclear matters was slightly relaxed in the early 1950's, primarily to improve U.S. access to foreign uranium supplies. The end of this policy was signalled in 1953 with President Eisenhower's "Atoms for Peace" address before the U.N. General Assembly. In that speech, President Eisenhower proposed open development of nuclear energy under voluntary international inspection, and the creation of an international agency to provide technical assistance and to conduct inspections. In 1954 Congress rewrote the Atomic Energy Act to open the way for development of commercial nuclear power and for U.S. nuclear exports and cooperation with other nations. The International Atomic Energy Agency was established in 1957.

The subsequent rapid development of nuclear power technology in Europe and the United States in the 1960's, however, revived concern about possible spread of nuclear weapons. This led to the negotiation of the Nuclear Non-Proliferation Treaty [NPT], which took effect in 1970. The NPT remains the keystone of the collection of treaties, understandings, and institutions that constitutes the "nuclear nonproliferation regime". It commits nonnuclear-weapons states not to acquire nuclear weapons; and nuclear-weapons states not to help other nations acquire them. All parties to the treaty commit themselves to facilitating the development of the peaceful uses of nuclear energy. Finally, the treaty commits the nuclear-weapons states to work toward nuclear disarmament.

The newly established nonproliferation regime was challenged in the mid-1970's by India's 1974 test of a nuclear device and by contracts negotiated by European suppliers to provide sensitive nuclear equipment and technology to South Korea, Pakistan, Argentina, and Brazil. These events led to a period of increased congressional attention to nuclear proliferation, which culminated in the passage of the Nuclear Non-Proliferation Act of 1978. This act set strict new conditions on U.S. nuclear exports and cooperation. Congressional attention to nuclear proliferation abated in the early 1980's, in part because there were no dramatic events comparable to the Indian test, and in part because "vertical proliferation" (that is, the arms race between the superpowers) overshadowed "horizontal proliferation" (the spreading of nuclear weapons to more nations). Nevertheless, as more nations acquire a nuclear industrial base capable of producing weapons-grade material, concern remains in some congressional quarters and public interest groups that these nations might produce nuclear weapons or that terrorists might seize nuclear materials to make nuclear explosives.

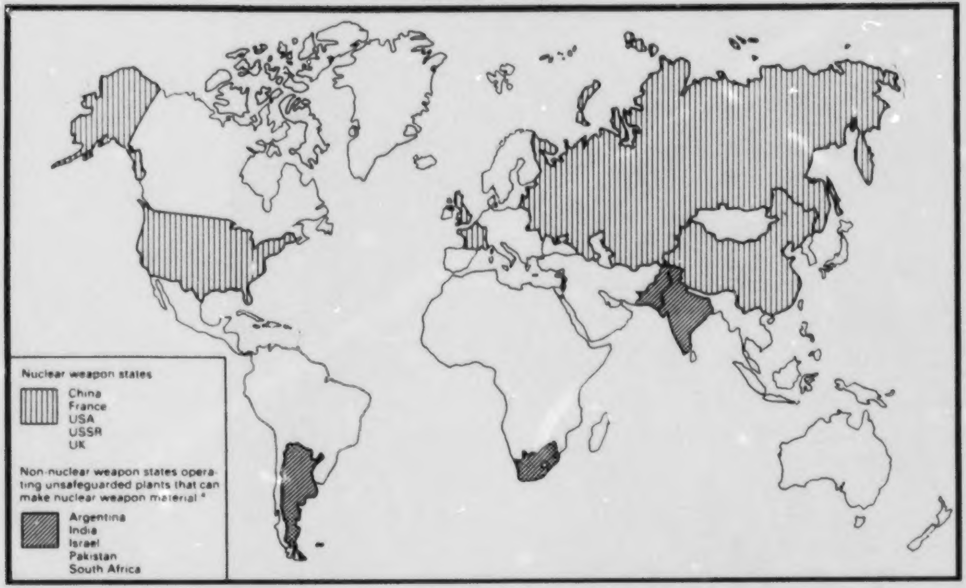
II. THE CURRENT PROLIFERATION SITUATION

Today there are five nations with nuclear arsenals (the United States, the Soviet Union, France, the United Kingdom, and China). Five other nations are operating unsafeguarded facilities (that is, facilities not open to international inspection) that can produce weapons-grade material (Israel, South Africa, India, Pakistan, and Argentina). Brazil may be in this category by the early 1990's Among these near-nuclear nations, India has tested a nuclear device but apparently has not produced a nuclear arsenal; Israel and South Africa are believed to be able to quickly manufacture nuclear weapons—indeed, some say both countries may already have small nuclear arsenals; Pakistan might be able to manufacture a nuclear device within a few years; and Argentina is nearing this capability, although it appears to lack the political and military incentives to produce nuclear weapons. South Korea and Taiwan previously had an interest in a nuclear weapons option, but U.S. pressure appears to have dissuaded them from pursuing this interest for the time being.

The following section highlights the proliferation status of nations whose nuclear programs are of current interest for U.S. nonproliferation policy. It focuses on the possession of enrichment and reprocessing facilities, which can be used to produce highly en-

WORLD PROLIFERATION MAP

(SIPRI 1985)


Nuclear weapon states
▥
China
France
USA
USSR
UK
Non-nuclear weapon states operating unsafeguarded plants that can make nuclear weapon material [a]
▨
Argentina
India
Israel
Pakistan
South Africa

X

[a] The status of Brazil is uncertain.

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Source: David Fischer and Paul Szasz, Safeguarding the Atom. SIPRI, 1985, p. vi.

riched uranium and plutonium, the fissionable materials used in nuclear weapons.[1]

A. PROLIFERATION STATUS OF KEY COUNTRIES

Argentina—Argentina is not party to the Non-Proliferation Treaty [NPT] and has not ratified the Latin American Nuclear Free Zone Treaty, the Treaty of Tlatelolco. Argentina has a substantial nuclear industrial base but is not now able to produce highly enriched uranium or plutonium in quantities sufficient to make a nuclear explosive, although it may have this ability within a few years. In 1983 Argentina announced the completion of a small enrichment plant; and it is nearing completion of a semicommercial scale reprocessing plant which will be open to international inspection only when processing safeguarded spent fuel. Argentina has the general scientific and industrial base necessary to develop and produce nuclear weapons, although there is no indication that it has decided to do so.

Brazil—Brazil has not signed the NPT, and its ratification of the Treaty of Tlateloloco has yet to take effect. Brazil has made the treaty's entry into force contingent upon all Latin American nations joining the treaty and all eligible countries joining its protocols. This would require Argentina and Cuba to adhere to the treaty, and completion of the pending French ratification of Protocol I. Brazil has a significant nuclear industrial base and has the technical and scientific ability to produce nuclear weapons, but does not have a source of plutonium or highly enriched uranium and is unlikely to have one until 1990 at the earliest. Neither does it appear to have any real incentives to develop nuclear weapons. In 1975 Brazil signed a nuclear supply contract with West Germany which includes supply of reprocessing and enrichment technology. Under the contract, these facilities would be safeguarded. However, Brazil is also independently developing centrifuge enrichment technology that will probably not be safeguarded.

India—India has not signed the NPT and has vehemently criticized the treaty as discriminatory toward nonnuclear-weapons states. In 1974 India tested a nuclear explosive and could probably produce a small nuclear arsenal if it chose to. India can now produce small amounts of plutonium, and will be able to produce significantly more in the next several years. India already has several unsafeguarded reactors and a reprocessing plant in operation and will soon be operating unsafeguarded nuclear power plants of a type than can easily produce high-quality plutonium. Indian leaders have disclaimed interest in nuclear weapons, but have hinted that India would make them if Pakistan should test a nuclear device. India's nuclear power industry is gaining experience in the design, construction, and operation of nuclear power plants which may enable it to supply technical assistance to other countries.

Israel—Israel has not signed the NPT. It is a widely held view that Israel either has a small nuclear arsenal or could produce nuclear weapons on short notice. Israel has maintained an ambiguous public posture regarding its nuclear weapon status, saying it will "not be the first to introduce nuclear weapons into the Middle East". Israel has an unsafeguarded reactor (Dimona) which reportedly is capable of producing enough plutonium for a few bombs a year. It is also thought to have an unsafeguarded reprocessing facility. Israel has conducted research in laser isotope separation that, if successful, could give it a new, highly efficient, and easy-to-conceal way to produce highly enriched uranium and perhaps to purify low-grade plutonium. In 1981 Israel bombed an Iraqi research reactor which it claimed would be used to produce material for nuclear weapons to be used against Israel.

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[1] For more detail, see Leonard Spector, Nuclear Proliferation Today, A Carnegie Endowment Book, 1984.

Pakistan—Pakistan has not signed the NPT, and has said it will not do so unless India does. Some recent events have aroused suspicion that Pakistan may be working on a nuclear explosive. In 1984 a Pakistani citizen was arrested for attempting to smuggle krytons out of the United States. One use for these devices is in nuclear explosive detonators. Pakistan announced in 1984 that it had mastered enrichment technology. Its enrichment plant, which is not safeguarded, has reportedly begun at least partial operation, although there is little information on the amount and grade of enriched uranium it can produce. Pakistan also has been trying to complete construction of a reprocessing plant, which would not be under safeguards. If Pakistan is able to produce highly enriched uranium, it could probably produce a crude nuclear explosive within a few years. However, if Pakistan were to test a nuclear device, it would face a cutoff of U.S economic and military aid and perhaps the resumption of Indian nuclear testing.

South Africa—South Africa has not signed the NPT. It is believed by many to be able to quickly produce nuclear weapons, and some say it may have a small nuclear arsenal. In 1977 a Soviet satellite discovered what appeared to be preparations for an underground nuclear test in the Kalahari desert. After strong pressures by the United States and others, these activities were halted. In 1979 a U.S. satellite detected a flash of light characteristic of a nuclear explosion over the ocean between South Africa and Antarctica. Some claimed this was a nuclear test conducted by South Africa. The Office of Science and Technology reviewed information on this event and concluded that the flash may have been a natural phenomenon. Nonetheless, an element of suspicion remains. South Africa currently can produce significant amounts of highly enriched uranium. It has been operating an unsafeguarded pilot enrichment plant since 1975 and is nearing completion of a commercial-scale plant which may be put under safeguards. According to some estimates, South Africa may have already accumulated enough highly enriched uranium for 15 to 25 nuclear devices, although this has not been confirmed. South Africa also has substantial uranium resources.

Iraq—Iraq is a party to the NPT. In 1981 Iraq's large French-supplied research reactor, which was nearing completion, was destroyed by Israel in an aerial bombing raid. Although the reactor was under safeguards, Israel claimed it was to be used to produce nuclear weapons material, a charge which Iraq denied. Israel's concerns stemmed from Iraq's insistence on using highly enriched uranium to fuel the reactor, from Iraq's purchase of large amounts of uranium in 1980, and from suspicion that Iraq could use the reactor to produce plutonium. Iraq's nuclear program has been dormant since the bombing, although Iraq says it intends to rebuild the reactor.

Libya—Libya has signed the NPT. However, some suspect Libya's nuclear intentions because of reports that it has tried (unsuccessfully) to buy nuclear weapons. Libya has almost no nuclear base, but it has been negotiating with the Soviet Union for several years over supply of a nuclear power station. The United States has pressed other Western suppliers not to help Libya develop nuclear power.

B. STATUS OF THE NON-PROLIFERATION REGIME

The term "Non-Proliferation Regime" refers to a loose collection of treaties, bilateral and multilateral agreements, voluntary guidelines and understandings, and international institutions that collectively are intended to prevent the diversion of nuclear materials and technology from civilian to military uses. The Nuclear Non-Proliferation Treaty [NPT] is the centerpiece of this regime. It commits non-nuclear-weapons members not to acquire nuclear weapons and commits nuclear-weapons members not to help other nations acquire them. The treaty currently has 124 members, although several important nations have not signed. These include Argentina, Brazil, India, Israel, Pakistan, and South Africa. It appears unlikely that any of these states will sign the treaty in the foreseeable future. In September 1985 NPT members will meet in a third quinquennial conference to review the performance of the treaty. The 1975 and 1980 review conferences were marked by disputes over superpower arms control and the conditions placed on nuclear supply. These disputes will probably arise again in the upcoming conference. However, it appears unlikely that any states will withdraw from the treaty or propose its termination.

The working heart of the NPT is the International Atomic Energy Agency (IAEA), which is charged with inspecting nuclear facilities and auditing inventories of nuclear materials to insure that no materials are diverted to make nuclear weapons. The creation of an international atomic agency was proposed by President Eisenhower in his 1953 "Atoms for Peace" address. The IAEA grew out of this proposal, and for many years the United States was the strongest supporter of the Agency. However, the Agency has been plagued by problems in recent years which threaten to reduce its effectiveness and have tended to reduce U.S. support. Questions have been raised about the Agency's ability to adequately safeguard sensitive nuclear facilities and to assure timely warning of any diversions. Another concern is that the Agency's effectiveness may be impaired by the bloc voting of developing nations who want to see greater IAEA emphasis on technical assistance, and have little interest in safeguards. In addition, some states have tended to make the Agency's General Conference another arena for their disputes with other states on matters having little to do with the business of the Agency. The two prime examples of such introduction of extraneous political issues are Arab bloc hostility toward Israel, and African bloc hostility toward South Africa.

In 1981 the Agency was caught up in an international crossfire after Israel bombed Iraq's research reactor. Israel's contention that the Agency's inspections were inadequate to detect diversions of nuclear material from the reactor cast doubt on the effectiveness of the Agency's safeguards system. A year after the bombing, and just after the massacre of Palestinian refugees by an Israeli-backed Christian militia in Lebanon, the General Conference of the IAEA voted to deny the credentials of the Israeli delegation. The United States argued that the voting procedure had been illegal, walked out of the Conference, and temporarily withdrew from the Agency and cut off funding. The United States resumed participation in the IAEA in 1983, but has reduced funding for the Agency, and has threatened to withdraw again if Israel's participation in the Agency is curtailed. Reduction of U.S. support and funding could weaken the Agency, particularly since it has been operating on a zero-growth budget although its safeguards workload has been growing.

Another important part of the Non-Proliferation Regime is the Nuclear Suppliers Guidelines. These guidelines constitute an informal agreement by major nuclear supplier nations committing them to restraint in the export of sensitive nuclear technologies. The Reagan administration has been attempting to persuade suppliers to specify in greater detail the items covered, and to require full-scope safeguards (that is, inspection of all nuclear facilities) as a condition for nuclear supply.

C. RECENT CHANGES IN U.S. NON-PROLIFERATION POLICY

Under the Carter administration, the United States significantly tightened conditions on its nuclear exports and cooperation; curtailed private reprocessing and pushed for cancellation of the Clinch River breeder reactor demonstration; and sought to discourage reprocessing, breeder development and use of plutonium in other countries. The Reagan administration has reaffirmed the prevention of nuclear proliferation as a fundamental foreign policy objective. However, it has applied nonproliferation policy on a case-by-case basis, and emphasizes the importance of the reliability of the United States as a nuclear supplier. Regarding plutonium use, President Reagan in his July 16, 1981, policy statement said it would be U.S. policy not to inhibit civil reprocessing or breeder development abroad in nations with advanced nuclear power programs where it does not constitute a proliferation risk. (Later statements indicated that the United States *would* continue to discourage reprocessing and plutonium use in countries that were viewed as proliferation risks.) The administration has offered long term prior approval for reprocessing to Euratom and Japan and has included such prior approval arrangements in agreements for cooperation with Finland, Norway, and Sweden. As for domestic plutonium use, the administration does not object to commercial production and use of plutonium in the United States provided no government subsidy is involved.

The Reagan administration has opposed additional conditions for U.S. nuclear exports, arguing that this would weaken U.S. influence and encourage nuclear partners to build their own enrichment or reprocessing facilities. In general, administration officials argue that since the United States is no longer the dominant supplier of nuclear technology, equipment, and materials, efforts to impose U.S. policies on other suppliers are likely to be ineffective and could jeopardize the cooperation that the United States now needs to realize its nonproliferation objectives.

III. LOOKING AHEAD: SOME POSSIBLE NON-PROLIFERATION INITIATIVES

The next 10 years are likely to be crucial for U.S. nonproliferation policy. In 1995 the parties to the NPT will meet to decide how the treaty will be extended. The success of efforts to prevent the spread of nuclear weapons, and the perception of nations that it is in their interests to avoid it, will affect prospects for a renewed mandate for the NPT in 1995. U.S. policies will play an important role in shaping these perceptions. Conversely, how long the treaty is extended in 1995 will have a major impact on U.S. nonproliferation policy. In addition, by 1995 the outlook for nuclear power should be much clearer; the future of plutonium as a nuclear fuel more visible; the success or failure of breeder reactors and laser isotope separation better established; the fate of international storage of plutonium and spent fuel decided; and the linkage between superpower arms control and proliferation more firmly established. Also by 1995 the nuclear weapons interests of borderline countries should be more apparent, although some countries viewed as safe today might have an interest in acquiring nuclear weapons by that time. All of these outcomes will affect the long-term role of the IAEA as a supplier of technical assistance to developing countries and as an international inspector of nuclear facilities.

U.S. officials can be expected to view the further spread of nuclear weapons as a threat to global security and to U.S. interests. Avoiding nuclear proliferation will remain an important, but probably not a foremost, U.S. foreign policy objective, barring unforeseen circumstances. It is commonly argued that the best way to prevent more nations from acquiring nuclear weapons is to remove or reduce the international tensions and conflicts which provide incentives, or at least perceived incentives, to develop nuclear weapons. However, the success of diplomacy cannot be guaranteed, and some nations will likely have an interest in acquiring nuclear weapons. Short-term measures to impede nuclear proliferation are therefore relevant. The following list of such measures is not intended to be definitive; its purpose is to provide a starting point for those who will be thinking about U.S. nonproliferation policy options in the years ahead.

STRENGTHEN THE WORLD PREDISPOSITION AGAINST NUCLEAR WEAPONS

Probably the most important barrier to the further spread of nuclear weapons is a general world public predisposition against them. On a more concrete level, many, if not most, nations view nuclear weapons as having little military utility and believe that acquiring them would cause so much suspicion among other countries that their own security would be threatened, not enhanced. Certainly most nations would view the acquisition of nuclear weapons by their neighbors as dangerous. The United States and other nations can be expected to try to convince nonnuclear-weapons states that the drawbacks of acquiring nuclear weapons outweigh any possible perceived advantages. However, for many countries, the nuclear weapons states lack credibility in making this argument because of their large, and still growing, nuclear arsenals.

ACHIEVE UNIVERSAL VERIFICATION THAT NUCLEAR MATERIALS AND FACILITIES INTENDED FOR PEACEFUL PURPOSES ARE NOT USED TO MAKE NUCLEAR WEAPONS

This would require all nonnuclear-weapons states to agree to international inspection of all civil nuclear activities.

STRENGTHEN THE NON-PROLIFERATION TREATY

The NPT would be considerably strengthened by bringing in some of the key holdout states, notably Argentina, Brazil, India, Israel, Pakistan, and South Africa. Judging by past experience, this will be difficult to do. One incentive would be to give preferences to NPT parties in the supply of nuclear technology and cooperation, which many developing nations value. If the NPT is to be extended in 1995, a majority of its members will have to be convinced that the access to peaceful nuclear technology and the security benefits that they gain as parties to the treaty outweigh the costs of foreswearing nuclear weapons and of opening nuclear facilities to inspection.

STRENGTHEN THE LATIN AMERICAN NUCLEAR FREE ZONE TREATY (THE TREATY OF TLATELOLCO)

The Treaty of Tlatelolco would be a much more effective arms control measure if it included all Latin American nations. To achieve this goal, Argentina would have to complete ratification, Brazil would have to lift its exceptions, and Cuba would have to become a party.

STRONGLY SUPPORT AND PROTECT THE INTERNATIONAL ATOMIC ENERGY AGENCY

The inspection function of the IAEA is vital if civil nuclear power in nonnuclear-weapon states is not to cause suspicions in neighboring countries. IAEA inspections can also help to deter diversion of nuclear material through risk of detection. However, the effectiveness of the Agency's safeguards system is threatened by political divisions among Agency members; inadequate funding; differences among members over the proper balance between the Agency's safeguards function and its technical assistance function; and the introduction of extraneous political issues into the Agency's Board of Governors and General Assembly. Some feel the technical assistance and safeguards functions are inherently contradictory and that the Agency should therefore be split in two.

STRENGTHEN AND EXPAND ACCEPTANCE OF THE NUCLEAR SUPPLIERS GUIDELINES

While the Nuclear Suppliers Guidelines remain informal and voluntary, they have proven quite durable. Ideally, in 1995 all of the present members will be continuing to adhere to present or improved export guidelines. A key test for these guidelines will be whether emerging supplier states, such as Argentina, Brazil, India, and China, can be persuaded to adopt them.

ASSESS THE UTILITY OF INTERNATIONAL STORAGE OF PLUTONIUM AND SPENT FUEL

Proposals were made in the mid-1970's for international storage of spent fuel and plutonium and for international supply of nuclear materials. Such arrangements could help prevent the diversion of nuclear materials by providing greater control over their use and movement. However, these proposals have run aground in international committees and appear to have lost active U.S. support. By 1995 the fate of such international institutions may well be determined.

AVOID THE FURTHER SPREAD OF SENSITIVE NUCLEAR TECHNOLOGIES AND MATERIALS

Whether a nonnuclear weapons state can quickly acquire nuclear weapons depends greatly upon its ability to produce or otherwise obtain highly enriched uranium or plutonium. For this reason, avoiding the spread of these materials and the facilities that produce them has been a major objective of U.S. nonproliferation policy. Current technological trends appear to be diminishing the possible advantages of highly enriched uranium as a nuclear fuel. However, a number of countries, including France, Argentina, Brazil, India, and Japan, remain interested in producing and using plutonium as a nuclear fuel. Laser isotope separation techniques are now being developed in some countries that, if proven feasible, would pose a significant new challenge to nonproliferation policy, since these technologies could produce highly enriched uranium or upgrade low-quality plutonium to weapons grade, and could be more easily concealed than conventional enrichment and reprocessing facilities. Countries developing these technologies could seek to prevent their spread to non-nuclear-weapon states, or at least try to insure that adequate safeguards procedures are developed for them.

BASIC DOCUMENTS

CONTENTS

Page

- Introduction 13
- Part I. International 14
  - United States atomic energy proposals. Presented to the United Nations Atomic Energy Commission by Bernard M. Baruch, the U.S. Representative, June 14, 1946 14
  - Address by President Eisenhower before the General Assembly of the United Nations on the peaceful uses of nuclear energy, December 8, 1953 25
  - Statute of the International Atomic Energy Agency 34
    - Members of the Agency, January 1984 48
  - Treaty for the Prohibition of Nuclear Weapons in Latin America (Treaty of Tlatelolco) 49
    - List of states that have signed or ratified the Treaty 66
    - List of states that have signed Protocol I to the Treaty 67
    - List of states that have signed Protocol II to the Treaty 67
  - Treaty on the Non-Proliferation of Nuclear Weapons, July 1, 1968 (The NPT) 68
    - List of states that have signed, ratified, or acceded to the Non-Proliferation Treaty 74
    - List of states that have not signed the NPT 78
    - List of states that have signed the NPT but have not yet ratified 78
    - List of nuclear weapons states that have ratified the NPT 78
  - Convention on the Physical Protection of Nuclear Material, 1980 79
  - List of states that have signed or ratified the Convention 88
- Part II. U.S. Legislation 89
  - The Atomic Energy Act of 1954 as amended. (Selected excerpts) 89
  - The International Atomic Energy participation Act of 1957 as amended 142
  - The Euratom Cooperation Act of 1958 as amended 146
  - The Foreign Assistance Act of 1961, as amended. (Selected excerpts) 150
  - The Nuclear Non-Proliferation Act of 1978. Excerpts of provisions not appearing in the Atomic Energy Act of 1954 as amended 155
  - Department of Energy Act of 1978—Civilian applications. Excerpts of secs. 203 and 208 171
  - Authorization, Appropriations—International Development Cooperation Act of 1979. (Excerpt) 173
  - U.S. Exports of Low-Enriched Uranium Fuel. Joint resolution permitting the supply of additional low enriched uranium, 1980 174
  - The International Security and Development Cooperation Act of 1981. (Selected excerpts) 175
  - The Convention on the Physical Protection of Nuclear Material Implementation Act of 1982 176
  - Nuclear Waste Policy Act of 1982. (Excerpt) 180
  - Boschwitz amendment to the Department of State Authorization Act, fiscal years 1984 and 1985 182
  - Summaries of non-proliferation legislation excluding the Nuclear Non-Proliferation Act. (From CRS Issue Brief IB 85052) 183
  - Congressional advisory resolutions 192
    - S. Res. 94, April 28, 1977. International cooperation to curb nuclear proliferation 192
    - H. Res. 177, July 17, 1981. U.S. nuclear nonproliferation policy 196
    - S. Res. 179, July 17, 1981. The International Nuclear Non-Proliferation Regime 199

Page

Part II. U.S. Legislation—Continued
Congressional advisory resolutions—Continued
H. Con. Res. 340. May 20, 1982. Urging the President to seek allied agreement at Versailles to limit nuclear exports 203
S. Con. Res. 96. May 27, 1982. Nuclear fuels export 206
Part III. Presidential policies, statements, and orders 209
President Ford 209
Statement on nuclear policy, October 28, 1976 209
President Carter 224
Nuclear power policy. Statement by the President on his decisions following a review of U.S. policy, April 7, 1977 224
The President's remarks announcing his decisions, supra. April 7, 1977. (Excerpt) 226
Nuclear nonproliferation. The President's message to Congress transmitting his proposed Nuclear Non-Proliferation Policy Act of 1977. April 27, 1977 228
Nuclear nonproliferation. Fact sheet on the proposed Nuclear Non-Proliferation Policy Act of 1977, April 27, 1977 230
U.S. export policy. Statement on reduction of export disincentives. February 27, 1980. (Excerpt) 233
President Reagan 234
Statement on U.S. nuclear non-proliferation policy. July 16, 1981 234
White House fact sheet on the President's message, July 16, 1981 236
Nuclear energy policy. Statement announcing a series of policy initiatives. October 8, 1981 240
Excerpt from the Department of State's noontime press briefing, re the President's policy on plutonium, June 9, 1982 242
Press guidance from the Department of State-OES on reprocessing and plutonium-use policy, June 9, 1982 243
Statement of Under Secretary of State Richard T. Kennedy before the Subcommittee on Energy, Nuclear Proliferation and government Processes, Committee on Governmental Affairs, United States Senate. September 9, 1982 (Excerpt) 246
Treaty on the Non-Proliferation of Nuclear Weapons. Statement by the President on the 15th anniversary of the Treaty, July 1, 1983 255
Executive Orders 256
Executive Order 10841, Sept. 30, 1959. Providing for the carrying out of certain provisions of the Atomic Energy Act of 1954, as amended, relating to international cooperation 256
Executive Order 11057, Oct. 18, 1962. Authorization for the communication of restricted data by the Department of State 258
Executive Order 11902, Feb. 2, 1976. Procedures for an export licensing policy as to nuclear materials and equipment 259
Executive Order 12055, April 27, 1978. Export of Special nuclear material to India 261
Executive Order 12058, May 11, 1978. Functions relating to nuclear non-proliferation 262
Executive Order 12409, Mar. 7, 1979. Nuclear cooperation with Euratom 264
Executive Order 12218, June 19, 1980. Export of special nuclear material and components to India 265
Executive Order 12295, Feb. 24, 1981. Nuclear cooperation with Euratom 266
Executive Order 12351, Mar. 9, 1982. Nuclear cooperation with Euratom 266
Executive Order 12463, Feb. 23, 1984. Nuclear cooperation with Euratom 266

BASIC DOCUMENTS

INTRODUCTION

U.S. nonproliferation policy is comprised of statutory requirements, congressional policy statements, and executive regulations, policy statements, and practices. U.S. policy functions within an international network of treaties, statutes, and understandings termed the "international nonproliferation regime". The following selection of documents provides basic information on the foundation of that regime and on the legislative and executive branch components of U.S. policy.

Part I. International

United States Atomic Energy Proposals

Presented to the United Nations Atomic Energy Commission by Bernard M. Baruch, the United States Representative, June 14, 1946

My Fellow Members of the United Nations Atomic Energy Commission, and My Fellow Citizens of the World:

We are here to make a choice between the quick and the dead. That is our business.

Behind the black portent of the new atomic age lies a hope which, seized upon with faith, can work our salvation. If we fail, then we have damned every man to be the slave of Fear. Let us not deceive ourselves: We must elect World Peace or World Destruction.

Science has torn from nature a secret so vast in its potentialities that our minds cower from the terror it creates. Yet terror is not enough to inhibit the use of the atomic bomb. The terror created by weapons has never stopped man from employing them. For each new weapon a defense has been produced, in time. But now we face a condition in which adequate defense does not exist.

Science, which gave us this dread power, shows that it *can* be made a giant help to humanity, but science does *not* show us how to prevent its baleful use. So we have been appointed to obviate that peril by finding a meeting of the minds and the hearts of our peoples. Only in the will of mankind lies the answer.

It is to express this will and make it effective that we have been assembled. We must provide the mechanism to assure that atomic energy is used for peaceful purposes and preclude its use in war. To that end, we must provide immediate, swift, and sure punishment of those who violate the agreements that are reached by the nations. Penalization is essential if peace is to be more than a feverish interlude between wars. And, too, the United Nations can prescribe individual responsibility and punishment on the principles applied at Nürnberg by the Union of Soviet Socialist Republics, the United Kingdom, France, and the United States—a formula certain to benefit the world's future.

In this crisis, we represent not only our governments but, in a larger way, we represent the peoples of the world. We must remember that the peoples do not belong to the governments but that the governments belong to the peoples. We must answer their demands; we must answer the world's longing for peace and security.

In that desire the United States shares ardently and hopefully. The search of science for the absolute weapon has reached fruition in this country. But she stands ready to proscribe and destroy this instrument—to lift its use from death to life—if the world will join in a pact to that end.

In our success lies the promise of a new life, freed from the heart-stopping fears that now beset the world. The beginning of victory for the great ideals for which millions have bled and died lies in building a workable plan. Now we approach fulfilment of the aspirations of mankind. At the end of the road lies the fairer, better, surer life we crave and mean to have.

Only by a lasting peace are liberties and democracies strengthened and deepened. War is their enemy. And it will not do to believe that any of us can escape war's devastation. Victor, vanquished, and neutrals alike are affected physically, economically, and morally.

Against the degradation of war we can erect a safeguard. That is the guerdon for which we reach. Within the scope of the formula we outline here there will be found, to those who seek it, the essential elements of our purpose. Others will see only emptiness. Each of us carries his own mirror in which is reflected hope—or determined desperation—courage or cowardice.

There is a famine throughout the world today. It starves men's bodies. But there is a greater famine—the hunger of men's spirit. That starvation can be cured by the conquest of fear, and the substitution of hope, from which springs faith—faith in each other, faith that we want to work together toward salvation, and determination that those who threaten the peace and safety shall be punished.

The peoples of these democracies gathered here have a particular concern with our answer, for their peoples hate war. They will have a heavy exaction to make of those who fail to provide an escape. They are not afraid of an internationalism that protects;

they are unwilling to be fobbed off by mouthings about narrow sovereignty, which is today's phrase for yesterday's isolation.

The basis of a sound foreign policy, in this new age, for all the nations here gathered, is that anything that happens, no matter where or how, which menaces the peace of the world, or the economic stability, concerns each and all of us.

That, roughly, may be said to be the central theme of the United Nations. It is with that thought we begin consideration of the most important subject that can engage mankind—life itself.

Let there be no quibbling about the duty and the responsibility of this group and of the governments we represent. I was moved, in the afternoon of my life, to add my effort to gain the world's quest, by the broad mandate under which we were created. The resolution of the General Assembly, passed January 24, 1946 in London, reads:

"*Section V. Terms of Reference of the Commission*

"The Commission shall proceed with the utmost despatch and enquire into all phases of the problem, and make such recommendations from time to time with respect to them as it finds possible. In particular the Commission shall make specific proposals:

"(*a*) For extending between all nations the exchange of basic scientific information for peaceful ends;

"(*b*) For control of atomic energy to the extent necessary to ensure its use only for peaceful purposes;

"(*c*) For the elimination from national armaments of atomic weapons and of all other major weapons adaptable to mass destruction;

"(*d*) For effective safeguards by way of inspection and other means to protect complying States against the hazards of violations and evasions.

"The work of the Commission should proceed by separate stages, the successful completion of each of which will develop the necessary confidence of the world before the next stage is undertaken. . . ."[1]

Our mandate rests, in text and in spirit, upon the outcome of the Conference in Moscow of Messrs. Molotov of the Union of Soviet Socialist Republics, Bevin of the United Kingdom, and Byrnes of the United States of America. The three Foreign

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[1] *Department of State Bulletin*, Feb. 10, 1946, p. 198.

Ministers on December 27, 1945 proposed the establishment of this body.[8]

Their action was animated by a preceding conference in Washington on November 15, 1945, when the President of the United States, associated with Mr. Attlee, Prime Minister of the United Kingdom, and Mr. Mackenzie King, Prime Minister of Canada, stated that international control of the whole field of atomic energy was immediately essential. They proposed the formation of this body. In examining that source, the Agreed Declaration, it will be found that the fathers of the concept recognized the final means of world salvation—the abolition of war. Solemnly they wrote:

> "We are aware that the only complete protection for the civilized world from the destructive use of scientific knowledge lies in the prevention of war. No system of safeguards that can be devised will of itself provide an effective guarantee against production of atomic weapons by a nation bent on aggression. Nor can we ignore the possibility of the development of other weapons, or of new methods of warfare, which may constitute as great a threat to civilization as the military use of atomic energy."[9]

Through the historical approach I have outlined, we find ourselves here to test if man can produce, through his will and faith, the miracle of peace, just as he has, through science and skill, the miracle of the atom.

The United States proposes the creation of an International Atomic Development Authority, to which should be entrusted all phases of the development and use of atomic energy, starting with the raw material and including—

1. Managerial control or ownership of all atomic-energy activities potentially dangerous to world security.
2. Power to control, inspect, and license all other atomic activities.
3. The duty of fostering the beneficial uses of atomic energy.
4. Research and development responsibilities of an affirmative character intended to put the Authority in the forefront of atomic knowledge and thus to enable it to comprehend, and therefore to detect, misuse of atomic energy. To be effective, the Authority must itself be the world's leader in the field of atomic knowledge

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[8] *Department of State Bulletin*, Dec. 30, 1945, p. 1031.

[9] *Ibid.*, Nov. 18, 1945, p. 781.

and development and thus supplement its legal authority with the great power inherent in possession of leadership in knowledge.

I offer this as a basis for beginning our discussion.

But I think the peoples we serve would not believe—and without faith nothing counts—that a treaty, merely outlawing possession or use of the atomic bomb, constitutes effective fulfilment of the instructions to this Commission. Previous failures have been recorded in trying the method of simple renunciation, unsupported by effective guaranties of security and armament limitation. No one would have faith in that approach alone.

Now, if ever, is the time to act for the common good. Public opinion supports a world movement toward security. If I read the signs aright, the peoples want a program not composed merely of pious thoughts but of enforceable sanctions—an international law with teeth in it.

We of this nation, desirous of helping to bring peace to the world and realizing the heavy obligations upon us arising from our possession of the means of producing the bomb and from the fact that it is part of our armament, are prepared to make our full contribution toward effective control of atomic energy.

When an adequate system for control of atomic energy, including the renunciation of the bomb as a weapon, has been agreed upon and put into effective operation and condign punishments set up for violations of the rules of control which are to be stigmatized as international crimes, we propose that—

1. Manufacture of atomic bombs shall stop;
2. Existing bombs shall be disposed of pursuant to the terms of the treaty; and
3. The Authority shall be in possession of full information as to the know-how for the production of atomic energy.

Let me repeat, so as to avoid misunderstanding: My country is ready to make its full contribution toward the end we seek, subject of course to our constitutional processes and to an adequate system of control becoming fully effective, as we finally work it out.

Now as to violations: In the agreement, penalties of as serious a nature as the nations may wish and as immediate and certain in their execution as possible should be fixed for—

1. Illegal possession or use of an atomic bomb;
2. Illegal possession, or separation, of atomic material suitable for use in an atomic bomb;
3. Seizure of any plant or other property belonging to or licensed by the Authority;

4. Wilful interference with the activities of the Authority;

5. Creation or operation of dangerous projects in a manner contrary to, or in the absence of, a license granted by the international control body.

It would be a deception, to which I am unwilling to lend myself, were I not to say to you and to our peoples that the matter of punishment lies at the very heart of our present security system. It might as well be admitted, here and now, that the subject goes straight to the veto power contained in the Charter of the United Nations so far as it relates to the field of atomic energy. The Charter permits penalization only by concurrence of each of the five great powers—the Union of Soviet Socialist Republics, the United Kingdom, China, France, and the United States.

I want to make very plain that I am concerned here with the veto power only as it affects this particular problem. There must be no veto to protect those who violate their solemn agreements not to develop or use atomic energy for destructive purposes.

The bomb does not wait upon debate. To delay may be to die. The time between violation and preventive action or punishment would be all too short for extended discussion as to the course to be followed.

As matters now stand several years may be necessary for another country to produce a bomb, *de novo*. However, once the basic information is generally known, and the Authority has established producing plants for peaceful purposes in the several countries, an illegal seizure of such a plant might permit a malevolent nation to produce a bomb in 12 months, and if preceded by secret preparation and necessary facilities perhaps even in a much shorter time. The time required—the advance warning given of the possible use of a bomb—can only be generally estimated but obviously will depend upon many factors, including the success with which the Authority has been able to introduce elements of safety in the design of its plants and the degree to which illegal and secret preparation for the military use of atomic energy will have been eliminated. Presumably no nation would think of starting a war with only one bomb.

This shows how imperative speed is in detecting and penalizing violations.

The process of prevention and penalization—a problem of profound statecraft—is, as I read it, implicit in the Moscow statement, signed by the Union of Soviet Socialist Republics, the United States, and the United Kingdom a few months ago.

But before a country is ready to relinquish any winning weapons it must have more than words to reassure it. It must have a guarantee of safety, not only against the offenders in the atomic area but against the illegal users of other weapons—bacteriological, biological, gas—perhaps—why not?—against war itself.

In the elimination of war lies our solution, for only then will nations cease to compete with one another in the production and use of dread "secret" weapons which are evaluated solely by their capacity to kill. This devilish program takes us back not merely to the Dark Ages but from cosmos to chaos. If we succeed in finding a suitable way to control atomic weapons, it is reasonable to hope that we may also preclude the use of other weapons adaptable to mass destruction. When a man learns to say "A" he can, if he chooses, learn the rest of the alphabet too.

Let this be anchored in our minds:

Peace is never long preserved by weight of metal or by an armament race. Peace can be made tranquil and secure only by understanding and agreement fortified by sanctions. We must embrace international cooperation or international disintegration.

Science has taught us how to put the atom to work. But to make it work for good instead of for evil lies in the domain dealing with the principles of human duty. We are now facing a problem more of ethics than of physics.

The solution will require apparent sacrifice in pride and in position, but better pain as the price of peace than death as the price of war.

I now submit the following measures as representing the fundamental features of a plan which would give effect to certain of the conclusions which I have epitomized.

1. General. The Authority should set up a thorough plan for control of the field of atomic energy, through various forms of ownership, dominion, licenses, operation, inspection, research, and management by competent personnel. After this is provided for, there should be as little interference as may be with the economic plans and the present private, corporate, and state relationships in the several countries involved.

2. Raw Materials. The Authority should have as one of its earliest purposes to obtain and maintain complete and accurate information on world supplies of uranium and thorium and to bring them under its dominion. The precise pattern of control for various types of deposits of such materials will have to depend upon the geological, mining, refining, and economic facts involved in different situations.

The Authority should conduct continuous surveys so that it will have the most complete knowledge of the world geology of uranium and thorium. Only after all current information on world sources of uranium and thorium is known to us all can equitable plans be made for their production, refining, and distribution.

3. Primary Production Plants. The Authority should exercise complete managerial control of the production of fissionable materials. This means that it should control and operate all plants producing fissionable materials in dangerous quantities and must own and control the product of these plants.

4. Atomic Explosives. The Authority should be given sole and exclusive right to conduct research in the field of atomic explosives. Research activities in the field of atomic explosives are essential in order that the Authority may keep in the forefront of knowledge in the field of atomic energy and fulfil the objective of preventing illicit manufacture of bombs. Only by maintaining its position as the best-informed agency will the Authority be able to determine the line between intrinsically dangerous and non-dangerous activities.

5. Strategic Distribution of Activities and Materials. The activities entrusted exclusively to the Authority because they are intrinsically dangerous to security should be distributed throughout the world. Similarly, stockpiles of raw materials and fissionable materials should not be centralized.

6. Non-Dangerous Activities. A function of the Authority should be promotion of the peacetime benefits of atomic energy.

Atomic research (except in explosives), the use of research reactors, the production of radioactive tracers by means of non-dangerous reactors, the use of such tracers, and to some extent the production of power should be open to nations and their citizens under reasonable licensing arrangements from the Authority. Denatured materials, whose use we know also requires suitable safeguards, should be furnished for such purposes by the Authority under lease or other arrangement. Denaturing seems to have been overestimated by the public as a safety measure.

7. Definition of Dangerous and Non-Dangerous Activities. Although a reasonable dividing line can be drawn between dangerous and non-dangerous activities, it is not hard and fast. Provision should, therefore, be made to assure constant re-examination of the questions and to permit revision of the dividing line as changing conditions and new discoveries may require.

8. Operations of Dangerous Activities. Any plant dealing with uranium or thorium after it once reaches the potential of dangerous use must be not only subject to the most rigorous and competent inspection by the Authority, but its actual operation shall be under the management, supervision, and control of the Authority.

9. Inspection. By assigning intrinsically dangerous activities exclusively to the Authority, the difficulties of inspection are reduced. If the Authority is the only agency which may lawfully conduct dangerous activities, then visible operation by others than the Authority will constitute an unambiguous danger signal. Inspection will also occur in connection with the licensing functions of the Authority.

10. Freedom of Access. Adequate ingress and egress for all qualified representatives of the Authority must be assured. Many of the inspection activities of the Authority should grow out of, and be incidental to, its other functions. Important measures of inspection will be associated with the tight control of raw materials, for this is a keystone of the plan. The continuing activities of prospecting, survey, and research in relation to raw materials will be designed not only to serve the affirmative development functions of the Authority but also to assure that no surreptitious operations are conducted in the raw-materials field by nations or their citizens.

11. Personnel. The personnel of the Authority should be recruited on a basis of proven competence but also so far as possible on an international basis.

12. Progress by Stages. A primary step in the creation of the system of control is the setting forth, in comprehensive terms, of the functions, responsibilities, powers, and limitations of the Authority. Once a charter for the Authority has been adopted, the Authority and the system of control for which it will be responsible will require time to become fully organized and effective. The plan of control will, therefore, have to come into effect in successive stages. These should be specifically fixed in the charter or means should be otherwise set forth in the charter for transitions from one stage to another, as contemplated in the resolution of the United Nations Assembly which created this Commission.

13. Disclosures. In the deliberations of the United Nations Commission on Atomic Energy, the United States is prepared to make available the information essential to a reasonable understanding of the proposals which it advocates. Further disclosures must be dependent, in the interests of all, upon the effective ratification of the treaty. When the Authority is actually created, the United States will join the other nations in making available the further information essential to that organization for the performance of its functions. As the successive stages of international control are reached, the United States will be prepared to yield, to the extent required by each stage, national control of activities in this field to the Authority.

14. International Control. There will be questions about the extent of control to be allowed to national bodies, when the Authority is established. Purely national authorities for control and development of atomic energy should to the extent necessary for the effective operation of the Authority be subordinate to it. This is neither an endorsement nor a disapproval of the creation of national authorities. The Commission should evolve a clear demarcation of the scope of duties and responsibilities of such national authorities.

And now I end. I have submitted an outline for present discussion. Our consideration will be broadened by the criticism of the United States proposals and by the plans of the other nations, which, it is to be hoped, will be submitted at their early convenience. I and my associates of the United States Delegation will make available to each member of this body books and pamphlets, including the Acheson-Lilienthal report, recently made by the United States Department of State, and the McMahon Committee Monograph No. 1 entitled "Essential Information on Atomic Energy" relating to the McMahon bill recently passed by the United States Senate, which may prove of value in assessing the situation.[4]

All of us are consecrated to making an end of gloom and hopelessness. It will not be an easy job. The way is long and thorny, but supremely worth traveling. All of us want to stand erect, with our faces to the sun, instead of being forced to burrow into the earth, like rats.

The pattern of salvation must be worked out by all for all.

The light at the end of the tunnel is dim, but our path seems to grow brighter as we actually begin our journey. We cannot yet light the way to the end. However, we hope the suggestions of my Government will be illuminating.

Let us keep in mind the exhortation of Abraham Lincoln, whose words, uttered at a moment of shattering national peril, form a complete text for our deliberation. I quote, paraphrasing slightly:

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[4] Department of State publication 2498; for excerpts from the Acheson-Lilienthal report see *Department of State Bulletin*, Apr. 7, 1946, p. 553. The text of the McMahon bill is S. Rept. 1211, 79th Cong.

"We cannot escape history. We of this meeting will be remembered in spite of ourselves. No personal significance or insignificance can spare one or another of us. The fiery trial through which we are passing will light us down in honor or dishonor to the latest generation.

"We say we are for Peace. The world will not forget that we say this. We know how to save Peace. The world knows that we do. We, even we here, hold the power and have the responsibility.

"We shall nobly save, or meanly lose, the last, best hope of earth. The way is plain, peaceful, generous, just—a way which, if followed, the world will forever applaud."

My thanks for your attention.

Address by President Eisenhower Before the General Assembly of the United Nations on the Peaceful Uses of Nuclear Energy. December 8, 1953

Madame President, Members of the General Assembly:

When Secretary General Hammarskjold's invitation to address this General Assembly reached me in Bermuda, I was just beginning a series of conferences with the Prime Ministers and Foreign Ministers of Great Britain and of France. Our subject was some of the problems that beset our world.

During the remainder of the Bermuda Conference, I had constantly in mind that ahead of me lay a great honor. That honor is mine today as I stand here, privileged to address the General Assembly of the United Nations.

At the same time that I appreciate the distinction of addressing you, I have a sense of exhilaration as I look upon this Assembly.

Never before in history has so much hope for so many people been gathered together in a single organization. Your deliberations and decisions during these somber years have already realized part of those hopes.

But the great tests and the great accomplishments still lie ahead. And in the confident expectation of those accomplishments, I would use the office which, for the time being, I hold, to assure you that the Government of the United States will remain steadfast in its support of this body. This we shall do in the conviction that you will provide a great share of the wisdom, the courage, and the faith which can bring to this world lasting peace for all nations, and happiness and well-being for all men.

Clearly, it would not be fitting for me to take this occasion to present to you a unilateral American report on Bermuda. Nevertheless, I assure you that in our deliberations on that lovely island we sought to invoke those same great concepts of universal peace and human dignity which are so clearly etched in your Charter.

Neither would it be a measure of this great opportunity merely to recite, however hopefully, pious platitudes.

I therefore decided that this occasion warranted my saying to you some of the things that have been on the minds and hearts of my legislative and executive associates and on mine for a great many months—thoughts I had originally planned to say primarily to the American people.

I know that the American people share my deep belief that if a danger exists in the world, it is a danger shared by all—and equally, that if hope exists in the mind of one nation, that hope should be shared by all.

Finally, if there is to be advanced any proposal designed to ease even by the smallest measure the tensions of today's world, what more appropriate audience could there be than the members of the General Assembly of the United Nations?

I feel impelled to speak today in a language that in a sense is new—one which I, who have spent so much of my life in the military profession, would have preferred never to use.

That new language is the language of atomic warfare.

The atomic age has moved forward at such a pace that every citizen of the world should have some comprehension, at least in comparative terms, of the extent of this development of the utmost significance to every one of us. Clearly, if the peoples of the world are to conduct an intelligent search for peace, they must be armed with the significant facts of today's existence.

My recital of atomic danger and power is necessarily stated in United States terms, for these are the only incontrovertible facts that I know. I need hardly point out to this Assembly, however, that this subject is global, not merely national in character.

On July 16, 1945, the United States set off the world's first atomic explosion. Since that date in 1945, the United States of America has conducted 42 test explosions.

Atomic bombs today are more than 25 times as powerful as the weapons with which the atomic age dawned, while hydrogen weapons are in the ranges of millions of tons of TNT equivalent.

Today, the United States' stockpile of atomic weapons, which, of course, increases daily, exceeds by many times the explosive equivalent of the total of all bombs and all shells that came from every plane and every gun in every theatre of war in all of the years of World War II.

A single air group, whether afloat or land-based, can now deliver to any reachable target a destructive cargo exceeding in power all the bombs that fell on Britain in all of World War II.

In size and variety, the development of atomic weapons has been no less remarkable. The development has been such that atomic weapons have virtually achieved conventional status within our armed services. In the United States, the Army, the Navy, the Air Force, and the Marine Corps are all capable of putting this weapon to military use.

But the dread secret, and the fearful engines of atomic might, are not ours alone.

In the first place, the secret is possessed by our friends and allies, Great Britain and Canada, whose scientific genius made a tremendous contribution to our original discoveries, and the designs of atomic bombs.

The secret is also known by the Soviet Union.

The Soviet Union has informed us that, over recent years, it has devoted extensive resources to atomic weapons. During this period, the Soviet Union has exploded a series of atomic devices, including at least one involving thermo-nuclear reactions.

If at one time the United States possessed what might have been called a monopoly of atomic power, that monopoly ceased to exist several years ago. Therefore, although our earlier start has permitted us to accumulate what is today a great quantitative advantage, the atomic realities of today comprehend two facts of even greater significance.

First, the knowledge now possessed by several nations will eventually be shared by others—possibly all others.

Second, even a vast superiority in numbers of weapons, and a consequent capability of devastating retaliation, is no preventive, of itself, against the fearful material damage and toll of human lives that would be inflicted by surprise aggression.

The free world, at least dimly aware of these facts, has naturally embarked on a large program of warning and defense systems. That program will be accelerated and expanded.

But let no one think that the expenditure of vast sums for weapons and systems of defense can guarantee absolute safety for the cities and citizens of any nation. The awful arithmetic of the atomic bomb does not permit of any such easy solution. Even against the most powerful defense, an aggressor in possession of the effective minimum number of atomic bombs for a surprise attack could probably place a sufficient number of his bombs on the chosen targets to cause hideous damage.

Should such an atomic attack be launched against the United

States, our reactions would be swift and resolute. But for me to say that the defense capabilities of the United States are such that they could inflict terrible losses upon an aggressor—for me to say that the retaliation capabilities of the United States are so great that such an aggressor's land would be laid waste—all this, while fact, is not the true expression of the purpose and the hope of the United States.

To pause there would be to confirm the hopeless finality of a belief that two atomic colossi are doomed malevolently to eye each other indefinitely across a trembling world. To stop there would be to accept helplessly the probability of civilization destroyed—the annihilation of the irreplaceable heritage of mankind handed down to us generation from generation—and the condemnation of mankind to begin all over again the age-old struggle upward from savagery toward decency, and right, and justice.

Surely no sane member of the human race could discover victory in such desolation. Could anyone wish his name to be coupled by history with such human degradation and destruction.

Occasional pages of history do record the faces of the "Great Destroyers" but the whole book of history reveals mankind's never-ending quest for peace, and mankind's God-given capacity to build.

It is with the book of history, and not with isolated pages, that the United States will ever wish to be identified. My country wants to be constructive, not destructive. It wants agreements, not wars, among nations. It wants itself to live in freedom, and in the confidence that the people of every other nation enjoy equally the right of choosing their own way of life.

So my country's purpose is to help us move out of the dark chamber of horrors into the light, to find a way by which the minds of men, the hopes of men, the souls of men everywhere, can move forward toward peace and happiness and well being.

In this quest, I know that we must not lack patience.

I know that in a world divided, such as ours today, salvation cannot be attained by one dramatic act.

I know that many steps will have to be taken over many months before the world can look at itself one day and truly realize that a new climate of mutually peaceful confidence is abroad in the world.

But I know, above all else, that we must start to take these steps—*now.*

The United States and its allies, Great Britain and France, have over the past months tried to take some of these steps. Let no one say that we shun the conference table.

On the record has long stood the request of the United States, Great Britain, and France to negotiate with the Soviet Union the problems of a divided Germany.

On that record has long stood the request of the same three nations to negotiate an Austrian Peace Treaty.

On the same record still stands the request of the United Nations to negotiate the problems of Korea.

Most recently, we have received from the Soviet Union what is in effect an expression of willingness to hold a Four Power Meeting. Along with our allies, Great Britain and France, we were pleased to see that this note did not contain the unacceptable preconditions previously put forward.

As you already know from our joint Bermuda communique, the United States, Great Britain, and France have agreed promptly to meet with the Soviet Union.

The Government of the United States approaches this conference with hopeful sincerity. We will bend every effort of our minds to the single purpose of emerging from that conference with tangible results toward peace—the only true way of lessening international tension.

We never have, we never will, propose or suggest that the Soviet Union surrender what is rightfully theirs.

We will never say that the peoples of Russia are an enemy with whom we have no desire ever to deal or mingle in friendly and fruitful relationship.

On the contrary, we hope that this coming Conference may initiate a relationship with the Soviet Union which will eventually bring about a free intermingling of the peoples of the East and of the West—the one sure, human way of developing the understanding required for confident and peaceful relations.

Instead of the discontent which is now settling upon Eastern Germany, occupied Austria, and the countries of Eastern Europe, we seek a harmonious family of free European nations, with none a threat to the other, and least of all a threat to the peoples of Russia.

Beyond the turmoil and strife and misery of Asia, we seek peaceful opportunity for these peoples to develop their natural resources and to elevate their lives.

These are not idle words or shallow visions. Behind them lies a story of nations lately come to independence, not as a result of war, but through free grant or peaceful negotiation. There is a record, already written, of assistance gladly given by nations of the West to needy peoples, and to those suffering the temporary effects of famine, drought, and natural disaster.

These are deeds of peace. They speak more loudly than promises or protestations of peaceful intent.

But I do not wish to rest either upon the reiteration of past proposals or the restatement of past deeds. The gravity of the time is such that every new avenue of peace, no matter how dimly discernible, should be explored.

There is at least one new avenue of peace which has not yet been well explored—an avenue now laid out by the General Assembly of the United Nations.

In its resolution of November 18th, 1953, this General Assembly suggested—and I quote—"that the Disarmament Commission study the desirability of establishing a sub-committee consisting of representatives of the Powers principally involved, which should seek in private an acceptable solution . . . and report on such a solution to the General Assembly and to the Security Council not later than 1 September 1954."

The United States, heeding the suggestion of the General Assembly of the United Nations, is instantly prepared to meet privately with such other countries as may be "principally involved," to seek "an acceptable solution" to the atomic armaments race which overshadows not only the peace, but the very life, of the world.

We shall carry into these private or diplomatic talks a new conception.

The United States would seek more than the mere reduction or elimination of atomic materials for military purposes.

It is not enough to take this weapon out of the hands of the soldiers. It must be put into the hands of those who will know how to strip its military casing and adapt it to the arts of peace.

The United States knows that if the fearful trend of atomic military buildup can be reversed, this greatest of destructive forces can be developed into a great boon, for the benefit of all mankind.

The United States knows that peaceful power from atomic energy is no dream of the future. That capability, already proved, is here—now—today. Who can doubt, if the entire body of the world's scientists and engineers had adequate amounts of fissionable material with which to test and develop their ideas, that this capability would rapidly be transformed into universal, efficient, and economic usage.

To hasten the day when fear of the atom will begin to disappear from the minds of people, and the governments of the East and West, there are certain steps that can be taken now.

I therefore make the following proposals:

The Governments principally involved, to the extent permitted by elementary prudence, to begin now and continue to make joint contributions from their stockpiles of normal uranium and fissionable materials to an International Atomic Energy Agency. We would expect that such an agency would be set up under the aegis of the United Nations.

The ratios of contributions, the procedures and other details would properly be within the scope of the "private conversations" I have referred to earlier.

The United States is prepared to undertake these explorations in good faith. Any partner of the United States acting in the same good faith will find the United States a not unreasonable or ungenerous associate.

Undoubtedly initial and early contributions to this plan would be small in quantity. However, the proposal has the great virtue that it can be undertaken without the irritations and mutual suspicions incident to any attempt to set up a completely acceptable system of world-wide inspection and control.

The Atomic Energy Agency could be made responsible for the impounding, storage, and protection of the contributed fissionable and other materials. The ingenuity of our scientists will provide special safe conditions under which such a bank of fissionable material can be made essentially immune to surprise seizure.

The more important responsibility of this Atomic Energy Agency would be to devise methods whereby this fissionable material would be allocated to serve the peaceful pursuits of mankind. Experts would be mobilized to apply atomic energy to the needs of agriculture, medicine, and other peaceful activities. A special purpose would be to provide abundant electrical energy in the power-starved areas of the world. Thus the contributing powers would be dedicating some of their strength to serve the needs rather than the fears of mankind.

The United States would be more than willing—it would be proud to take up with others "principally involved" the development of plans whereby such peaceful use of atomic energy would be expedited.

Of those "principally involved" the Soviet Union must, of course, be one.

I would be prepared to submit to the Congress of the United States, and with every expectation of approval, any such plan that would:

First—encourage world-wide investigation into the most effective peacetime uses of fissionable material, and with the certainty that they had all the material needed for the conduct of all experiments that were appropriate;

Second—begin to diminish the potential destructive power of the world's atomic stockpiles;

Third—allow all peoples of all nations to see that, in this enlightened age, the great powers of the earth, both of the East and of the West, are interested in human aspirations first, rather than in building up the armaments of war;

Fourth—open up a new channel for peaceful discussion, and initiate at least a new approach to the many difficult problems that must be solved in both private and public conversations, if the world is to shake off the inertia imposed by fear, and is to make positive progress toward peace.

Against the dark background of the atomic bomb, the United States does not wish merely to present strength, but also the desire and the hope for peace.

The coming months will be fraught with fateful decisions. In this Assembly; in the capitals and military headquarters of the world; in the hearts of men everywhere, be they governors or governed, may they be the decisions which will lead this world out of fear and into peace.

To the making of these fateful decisions, the United States pledges before you—and therefore before the world—its determination to help solve the fearful atomic dilemma—to devote its entire heart and mind to find the way by which the miraculous inventiveness of man shall not be dedicated to his death, but consecrated to his life.

I again thank the delegates for the great honor they have done me, in inviting me to appear before them, and in listening to me so courteously. Thank you.

NOTE: The President's opening words referred to Mme. Vijaya Pandit, President of the United Nations General Assembly.

STATUTE OF THE INTERNATIONAL ATOMIC ENERGY AGENCY

ARTICLE I

Establishment of the Agency

The Parties hereto establish an International Atomic Energy Agency (hereinafter referred to as "the Agency") upon the terms and conditions hereinafter set forth.

ARTICLE II

Objectives

The Agency shall seek to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world. It shall ensure, so far as it is able, that assistance provided by it or at its request or under its supervision or control is not used in such a way as to further any military purpose.

ARTICLE III

Functions

A. The Agency is authorized:

1. To encourage and assist research on, and development and practical application of, atomic energy for peaceful uses throughout the world; and, if requested to do so, to act as an intermediary for the purposes of securing the performance of services or the supplying of materials, equipment, or facilities by one member of the Agency for another; and to perform any operation or service useful in research on, or development or practical application of, atomic energy for peaceful purposes;

2. To make provision, in accordance with this Statute, for materials, services, equipment, and facilities to meet the needs of research on, and development and practical application of, atomic energy for peaceful purposes, including the production of electric power, with due consideration for the needs of the under-developed areas of the world;

3. To foster the exchange of scientific and technical information on peaceful uses of atomic energy;

4. To encourage the exchange and training of scientists and experts in the field of peaceful uses of atomic energy;

5. To establish and administer safeguards designed to ensure that special fissionable and other materials, services, equipment, facilities, and information made available by the Agency or at its request or under its supervision or control are not used in such a way as to further any military purpose; and to apply safeguards, at the request of the parties, to any bilateral or multilateral arrangement, or at the request of a State, to any of that State's activities in the field of atomic energy;

6. To establish or adopt, in consultation and, where appropriate, in collaboration with the competent organs of the United Nations and with the specialized agencies concerned, standards of safety for protection of health and minimization of danger to life and property (including such standards for labour conditions), and to provide for the application of these standards to its own operations as well as to the operations making use of materials, services, equipment, facilities, and information made available by the Agency or at its request or under its control or supervision; and to provide for the application of these standards, at the request of the parties, to operations under any bilateral or multilateral arrangement, or, at the request of a State, to any of that State's activities in the field of atomic energy;

7. To acquire or establish any facilities, plant and equipment useful in carrying out its authorized functions, whenever the facilities, plant, and equipment otherwise available to it in the area concerned are inadequate or available only on terms it deems unsatisfactory.

B. In carrying out its functions, the Agency shall:

1. Conduct its activities in accordance with the purposes and principles of the United Nations to promote peace and international co-operation, and in conformity with policies of the United Nations furthering the establishment of safeguarded worldwide disarmament and in conformity with any international agreements entered into pursuant to such policies;

2. Establish control over the use of special fissionable materials received by the Agency, in order to ensure that these materials are used only for peaceful purposes;

3. Allocate its resources in such a manner as to secure efficient utilization and the greatest possible general benefit in all areas of the world, bearing in mind the special needs of the under-developed areas of the world;

4. Submit reports on its activities annually to the General Assembly of the United Nations and, when appropriate, to the Security Council: if in connexion with the activities of the Agency there should arise questions that are within the competence of the Security Council, the Agency shall notify the Security Council; as the organ bearing the main responsibility for the maintenance of international peace and security, and may also take the measures open to it under this Statute, including those provided in paragraph C of article XII;

5. Submit reports to the Economic and Social Council and other organs of the United Nations on matters within the competence of these organs.

C. In carrying out its functions, the Agency shall not make assistance to members subject to any political, economic, military, or other conditions incompatible with the provisions of this Statute.

D. Subject to the provisions of this Statute and to the terms of agreements concluded between a State or a group of States and the Agency which shall be in accordance with the provisions of the Statute, the activities of the Agency shall be carried out with due observance of the sovereign rights of States.

ARTICLE IV

Membership

A. The initial members of the Agency shall be those States Members of the United Nations or of any of the specialized agencies which shall have signed this Statute within ninety days after it is opened for signature and shall have deposited an instrument of ratification.

B. Other members of the Agency shall be those States, whether or not Members of the United Nations or of any of the specialized agencies, which deposit an instrument of acceptance of this Statute after their membership has been approved by the General Conference upon the recommendation of the Board of Governors. In recommending and approving a State for membership, the Board of Governors and the General Conference shall determine that the State is able and willing to carry out the obligations of membership in the Agency, giving due consideration to its ability and willingness to act in accordance with the purposes and principles of the Charter of the United Nations.

C. The Agency is based on the principle of the sovereign equality of all its members, and all members, in order to ensure to all of them the rights and benefits resulting from membership, shall fulfil in good faith the obligations assumed by them in accordance with this Statute.

ARTICLE V

General Conference

A. A General Conference consisting of representatives of all members shall meet in regular annual session and in such special sessions as shall be convened by the Director General at the request of the Board of Governors or of a majority of members. The sessions shall take place at the headquarters of the Agency unless otherwise determined by the General Conference.

B. At such sessions, each member shall be represented by one delegate who may be accompanied by alternates and by advisers. The cost of attendance of any delegation shall be borne by the member concerned.

C. The General Conference shall elect a President and such other officers as may be required at the beginning of each session. They shall hold office for the duration of the session. The General Conference, subject to the provisions of this Statute, shall adopt its own rules of procedure. Each member shall have one vote. Decisions pursuant to paragraph H of article XIV, paragraph C of article XVIII and paragraph B of article XIX shall be made by a two-thirds majority of the members present and voting. Decisions on other questions, including the determination of additional questions or categories of questions to be decided by a two-thirds majority, shall be made by a majority of the members present and voting. A majority of members shall constitute a quorum.

D. The General Conference may discuss any questions or any matters within the scope of this Statute or relating to the powers and functions of any organs provided for in this Statute, and may make recommendations to the membership of the Agency or to the Board of Governors or to both on any such questions or matters.

E. The General Conference shall:

1. Elect members of the Board of Governors in accordance with article VI;

2. Approve States for membership in accordance with article IV;

3. Suspend a member from the privileges and rights of membership in accordance with article XIX;

4. Consider the annual report of the Board;

5. In accordance with article XIV, approve the budget of the Agency recommended by the Board or return it with recommendations as to its entirety or parts to the Board, for resubmission to the General Conference;

6. Approve reports to be submitted to the United Nations as required by the relationship agreement between the Agency and the United Nations, except reports referred to in paragraph C of article XII, or return them to the Board with its recommendations;

7. Approve any agreement or agreements between the Agency and the United Nations and other organizations as provided in article XVI or return such agreements with its recommendations to the Board, for resubmission to the General Conference;

8. Approve rules and limitations regarding the exercise of borrowing powers by the Board, in accordance with paragraph G of article XIV; approve rules regarding the acceptance of voluntary contributions to the Agency; and approve, in accordance with paragraph F of article XIV, the manner in which the general fund referred to in that paragraph may be used;

9. Approve amendments to this Statute in accordance with paragraph C of article XVIII;

10. Approve the appointment of the Director General in accordance with paragraph A of article VII.

F. The General Conference shall have the authority:

1. To take decisions on any matter specifically referred to the General Conference for this purpose by the Board;

2. To propose matters for consideration by the Board and request from the Board reports on any matter relating to the functions of the Agency.

ARTICLE VI

Board of Governors

A. The Board of Governors shall be composed as follows:

1. The outgoing Board of Governors (or in the case of the first Board, the Preparatory Commission referred to in Annex I) shall designate for membership on the Board the five members most advanced in the technology of atomic energy including the production of source materials and the member most advanced in the technology of atom-

ic energy including the production of source materials in each of the following areas not represented by the aforesaid five:

(1) North America
(2) Latin America
(3) Western Europe
(4) Eastern Europe
(5) Africa and the Middle East
(6) South Asia
(7) South East Asia and the Pacific
(8) Far East.

2. The outgoing Board of Governors (or in the case of the first Board, the Preparatory Commission referred to in Annex I) shall designate for membership on the Board two members from among the following other producers of source materials: Belgium, Czechoslovakia, Poland, and Portugal; and shall also designate for membership on the Board one other member as a supplier of technical assistance. No member in this category in any one year will be eligible for redesignation in the same category for the following year.

3. The General Conference shall elect twelve members to membership on the Board of Governors, with due regard to equitable representation on the Board as a whole of the members in the areas listed in sub-paragraph A-1 of this article, so that the Board shall at all times include in this category three representatives of the area of Latin America, three representatives of the area of Africa and the Middle East and a representative of each of the remaining areas except North America. Except for the five members chosen for a term of one year in accordance with paragraph D of this article, no member in this category in any one term of office will be eligible for re-election in the same category for the following term of office.

B. The designations provided for in subparagraphs A-1 and A-2 of this article shall take place not less than sixty days before each regular annual session of the General Conference. The elections provided for in sub-paragraph A-3 of this article shall take place at regular annual sessions of the General Conference.

C. Members represented on the Board of Governors in accordance with sub-paragraphs A-1 and A-2 of this article shall hold office from the end of the next regular annual session of the General Conference after their designation until the end of the following regular annual session of the General Conference.

D. Members represented on the Board of Governors in accordance with sub-paragraph A-3 of this article shall hold office from the end of the regular annual session of the General Conference at which they are elected until the end of the second regular annual session of the General Conference thereafter. In the election of these members for the first Board, however, five shall be chosen for a term of one year.

E. Each member of the Board of Governors shall have one vote. Decisions on the amount of the Agency's budget shall be made by a two-thirds majority of those present and voting, as provided in paragraph H of article XIV. Decisions on other questions, including determination of additional questions or categories of questions to be decided by a two-thirds majority, shall be made by a majority of those present and voting. Two-thirds of all members of the Board shall constitute a quorum.

F. The Board of Governors shall have authority to carry out the functions of the Agency in accordance with this Statute, subject to its responsibilities to the General Conference as provided in this Statute.

G. The Board of Governors shall meet at such times as it may determine. The meetings shall take place at the headquarters of the Agency unless otherwise determined by the Board.

H. The Board of Governors shall elect a Chairman and other officers from among its members and, subject to the provisions of this Statute, shall adopt its own rules of procedure.

I. The Board of Governors may establish such committees as it deems advisable. The Board may appoint persons to represent it in its relations with other organizations.

J. The Board of Governors shall prepare an annual report to the General Conference concerning the affairs of the Agency and any projects approved by the Agency. The Board shall also prepare for submission to the General Conference such reports as the Agency is or may be required to make to the United Nations or to any other organization the work of which is related to that of the Agency. These reports, along with the annual reports, shall be submitted to members of the Agency at least one month before the regular annual session of the General Conference.

ARTICLE VII

Staff

A. The staff of the Agency shall be headed by a Director General. The Director General shall be appointed by the Board of Governors with the approval of the General Conference for a term of four years. He shall be the chief administrative officer of the Agency.

B. The Director General shall be responsible for the appointment, organization, and functioning of the staff and shall be under the authority of and subject to the control of the Board of Governors. He shall perform his duties in accordance with regulations adopted by the Board.

C. The staff shall include such qualified scientific and technical and other personnel as may be required to fulfil the objectives and functions of the Agency. The Agency shall be guided by the principle that its permanent staff shall be kept to a minimum.

D. The paramount consideration in the recruitment and employment of the staff and in the determination of the conditions of service shall be to secure employees of the highest standards of efficiency, technical competence, and integrity. Subject to this consideration, due regard shall be paid to the contributions of members to the Agency and to the importance of recruiting the staff on as wide a geographical basis as possible.

E. The terms and conditions on which the staff shall be appointed, remunerated, and dismissed shall be in accordance with regulations made by the Board of Governors, subject to the provisions of this Statute and to general rules approved by the General Conference on the recommendation of the Board.

F. In the performance of their duties, the Director General and the staff shall not seek or receive instructions from any source external to the Agency. They shall refrain from any action which might reflect on their position as officials of the Agency; subject to their responsibilities to the Agency, they shall not disclose any industrial secret or other confidential information coming to their knowledge by reason of their official duties for the Agency. Each member undertakes to respect the international character of the responsibilities of the Director General and the staff and shall not seek to influence them in the discharge of their duties.

G. In this article the term "staff" includes guards.

ARTICLE VIII

Exchange of information

A. Each member should make available such information as would, in the judgement of the member, be helpful to the Agency.

B. Each member shall make available to the Agency all scientific information developed as a result of assistance extended by the Agency pursuant to article XI.

C. The Agency shall assemble and make available in an accessible form the information made available to it under paragraph A and B of this article. It shall take positive steps to encourage the exchange among its members of information relating to the nature and peaceful uses of atomic energy and shall serve as an intermediary among its members for this purpose.

ARTICLE IX

Supplying of materials

A. Members may make available to the Agency such quantities of special fissionable materials as they deem advisable and on such terms as shall be agreed with the Agency. The material made available to the Agency may, at the discretion of the member making them available, be stored either by the member concerned or, with the agreement of the Agency, in the Agency's depots.

B. Members may also make available to the Agency source materials as defined in article XX and other materials. The Board of Governors shall determine the quantities of such materials which the Agency will accept under agreements provided for in article XIII.

C. Each member shall notify the Agency of the quantities, form, and composition of special fissionable materials, source materials, and other materials which that member is prepared, in conformity with its laws, to make available immediately or during a period specified by the Board of Governors.

D. On request of the Agency a member shall, from the materials which it has made available, without delay deliver to another member or group of members such quantities of such materials as the Agency may specify, and shall without delay deliver to the Agency itself such quantities of such materials as are really necessary for operations and scientific research in the facilities of the Agency.

E. The quantities, form and composition of materials made available by any member may be changed at any time by the member with the approval of the Board of Governors.

F. An initial notification in accordance with paragraph C of this article shall be made within three months of the entry into force of this Statute with respect to the member concerned. In the absence of a contrary decision of the Board of Governors, the materials initially made available shall be for the period of the calendar year succeeding the year when this Statute takes effect with respect to the member concerned. Subsequent notifications shall likewise, in the absence of a contrary action by the Board, relate to the period of the calendar year following the notification and shall be made no later the first day of November of each year.

G. The Agency shall specify the place and method of delivery and, where appropriate, the form and composition, of materials which it has requested a member to deliver from the amounts which that member has notified the Agency it is prepared to make available. The Agency shall also verify the quantities of materials delivered and shall report those quantities periodically to the members.

H. The Agency shall be responsible for storing and protecting materials in its possession. The Agency shall ensure that these materials shall be safeguarded against (1) hazards of the weather, (2) unauthorized removal or diversion, (3) damage or destruction, including sabotage, and (4) forcible seizure. In storing special fissionable materials in its possession, the Agency shall ensure the geographical distribution of these materials in such a way as not to allow concentration of large amounts of such materials in any country or region of the world.

I. The Agency shall as soon as practicable establish or acquire such of the following as may be necessary:

1. Plant, equipment, and facilities for the receipt, storage, and issue of materials;

2. Physical safeguards;
3. Adequate health and safety measures;
4. Control laboratories for the analysis and verification of materials received;
5. Housing and administrative facilities for any staff required for the foregoing.

J. The materials made available pursuant to this article shall be used as determined by the Board of Governors in accordance with the provisions of this Statute. No member shall have the right to require that the materials it makes available to the Agency be kept separately by the Agency or to designate the specific project in which they must be used.

ARTICLE X

Services, equipment, and facilities

Members may make available to the Agency services, equipment, and facilities which may be of assistance in fulfilling the Agency's objectives and functions.

ARTICLE XI

Agency projects

A. Any member or group of members of the Agency desiring to set up any project for research on, or development or practical application of, atomic energy for peaceful purposes may request the assistance of the Agency in securing special fissionable and other materials, services, equipment, and facilities necessary for this purpose. Any such request shall be accompanied by an explanation of the purpose and extent of the project and shall be considered by the Board Governors.

B. Upon request, the Agency may also assist any member or group of members to make arrangements to secure necessary financing from outside sources to carry out such projects. In extending this assistance, the Agency will not be required to provide any guarantees or to assume any financial responsibility for the project.

C. The Agency may arrange for the supplying of any materials, services, equipment, and facilities necessary for the project by one or more members or may itself undertake to provide any or all of these directly, taking into consideration the wishes of the member or members making the request.

D. For the purpose of considering the request, the Agency may send into the territory of the member or group of members making the request a person or persons qualified to examine the project. For this purpose the Agency may, with the approval of the member or group of members making the request, use members of its own staff or employ suitably qualified nationals of any member.

E. Before approving a project under this article, the Board of Governors shall give due consideration to:

1. The usefulness of the project, including its scientific and technical feasibility;
2. The adequacy of plans, funds, and technical personnel to assure the effective execution of the project;
3. The adequacy of proposed health and safety standards for handling and storing materials and for operating facilities;
4. The inability of the member of group of members making the request to secure the necessary finances, materials, facilities, equipment, and services;
5. The equitable distribution of materials and other resources available to the Agency;
6. The special needs of the under-developed areas of the world; and
7. Such other matters as may be relevant.

F. Upon approving a project, the Agency shall enter into an agreement with the member or group of members submitting the project, which agreement shall:

1. Provide for allocation to the project of any required special fissionable or other materials;

2. Provide for transfer of special fissionable materials from their then place of custody, whether the materials be in the custody of the Agency or of the member making them available for use in Agency projects, to the member or group of members submitting the project, under conditions which ensure the safety of any shipment required and meet applicable health and safety standards;

3. Set forth the terms and conditions, including charges, on which any materials, services, equipment, and facilities are to be provided by the Agency itself, and, if any such materials, services, equipment, and facilities are to be provided by a member, the terms and conditions as arranged for by the member or group of members submitting the project and the supplying member;

4. Include undertakings by the member or group of members submitting the project: *(a)* that the assistance provided shall not be used in such a way as to further any military purpose; and *(b)* that the project shall be subject to the safeguards provided for in article XII, the relevant safeguards being specified in the agreement;

5. Make appropriate provision regarding the rights and interests of the Agency and the member or members concerned in any inventions or discoveries, or any patents therein, arising from the project;

6. Make appropriate provision regarding settlement of disputes;

7. Include such other provisions as may be appropriate.

G. The provisions of this article shall also apply where appropriate to a request for materials, services, facilities, or equipment in connexion with an existing project.

ARTICLE XII

Agency safeguards

A. With respect to any Agency project, or other arrangement where the Agency is requested by the parties concerned to apply safeguards, the Agency shall have the following rights and responsibilities to the extent relevant to the project or arrangement:

1. To examine the design of specialized equipment and facilities, including nuclear reactors, and to approve it only from the view-point of assuring that it will not further any military purpose, that it complies with applicable health and safety standards, and that it will permit effective application of the safeguards provided for in this article;

2. To require the observance of any health and safety measures prescribed by the Agency;

3. To require the maintenance and production of operating records to assist in ensuring accountability for source and special fissionable materials used or produced in the project or arrangement;

4. To call for and receive progress reports;

5. To approve the means to be used for the chemical processing of irradiated materials solely to ensure that this chemical processing will not lend itself to diversion of materials for military purposes and will comply with applicable health and safety standards; to require that special fissionable materials recovered or produced as a by-product be used for peaceful purposes under continuing Agency safeguards for research or in reactors, existing or under construction, specified by the member or members concerned; and to require deposit with the Agency of any excess of any special fissionable materials recovered or produced as a by-product over what is needed for the above-stated uses in order to prevent stock-piling of these materials, provided that thereafter at the request of the member or members concerned special fissionable materials so deposited with the Agency shall be returned promptly to the member or members concerned for use under the same provisions as stated above;

6. To send into the territory of the recipient State or States inspectors, designated by the Agency after consultation with the State or States concerned, who shall have

access at all times to all places and data and to any person who by reason of his occupation deals with materials, equipment, or facilities which are required by this Statute to be safeguarded, as necessary to account for source and special fissionable materials supplied and fissionable products and to determine whether there is compliance with the undertaking against use in furtherance of any military purpose referred to in sub-paragraph F-4 of article XI, with the health and safety measures referred to in sub-paragraph A-2 of this article, and with any other conditions prescribed in the agreement between the Agency and the State or States concerned. Inspectors designated by the Agency shall be accompanied by representatives of the authorities of the State concerned, if that State so requests, provided that the inspectors shall not thereby be delayed or otherwise impeded in the exercise of their functions;

7. In the event of non-compliance and failure by the recipient State or States to take requested corrective steps within a reasonable time, to suspend or terminate assistance and withdraw any materials and equipment made available by the Agency or a member in furtherance of the project.

B. The Agency shall, as necessary, establish a staff of inspectors. The staff of inspectors shall have the responsibility of examining all operations conducted by the Agency itself to determine whether the Agency is complying with the health and safety measures prescribed by it for application to projects subject to its approval, supervision or control, and whether the Agency is taking adequate measures to prevent the source and special fissionable materials in its custody or used or produced in its own operations from being used in furtherance of any military purpose. The Agency shall take remedial action forthwith to correct any non-compliance or failure to take adequate measures.

C. The staff of inspectors shall also have the responsibility of obtaining and verifying the accounting referred to in sub-paragraph A-6 of this article and of determining whether there is compliance with the undertaking referred to in sub-paragraph F-4 of article XI, with the measures referred to in sub-paragraph A-2 of this article, and with all other conditions of the project prescribed in the agreement between the Agency and the State or States concerned. The inspectors shall report any non-compliance to the Director General who shall thereupon transmit the report to the Board of Governors. The Board shall call upon the recipient State or States to remedy forthwith any non-compliance which it finds to have occurred. The Board shall report the non-compliance to all members and to the Security Council and General Assembly of the United Nations. In the event of failure of the recipient State or States to take fully corrective action within a reasonable time, the Board may take one or both of the following measures: direct curtailment or suspension of assistance being provided by the Agency or by a member, and call for the return of materials and equipment made available to the recipient member or group of members. The Agency may also, in accordance with article XIX, suspend any noncomplying member from the exercise of the privileges and rights of membership.

ARTICLE XIII

Reimbursement of members

Unless otherwise agreed upon between the Board of Governors and the member furnishing to the Agency materials, services, equipment, or facilities, the Board shall enter into an agreement with such member providing for reimbursement for the items furnished.

ARTICLE XIV

Finance

A. The Board of Governors shall submit to the General Conference the annual budget estimates for the expenses of the Agency. To facilitate the work of the Board in this regard, the Director General shall initially prepare the budget estimates. If the General Conference does not approve the estimates, it shall return them together with its recommendations to the Board. The Board shall then submit further estimates to the General Conference for its approval.

B. Expenditures of the Agency shall be classified under the following categories:

1. Administrative expenses: these shall include:

(a) Costs of the staff of the Agency other than the staff employed in connexion with materials, services, equipment, and facilities referred to in sub-paragraph B-2 below; costs of meetings; and expenditures required for the preparation of Agency projects and for the distribution of information;

(b) Costs of implementing the safeguards referred to in article XII in relation to Agency projects or, under sub-paragraph A-5 of article III, in relation to any bilateral or multilateral arrangement, together with the costs of handling and storage of special fissionable material by the Agency other than the storage and handling charges referred to in paragraph E below;

2. Expenses, other than those included in sub-paragraph 1 of this paragraph, in connexion with any materials, facilities, plant, and equipment acquired or established by the Agency in carrying out its authorized functions, and the costs of materials, services, equipment, and facilities provided by it under agreements with one or more members.

C. In fixing the expenditures under subparagraph B-1 *(b)* above, the Board of Governors shall deduct such amounts as are recoverable under agreements regarding the application of safeguards between the Agency and parties to bilateral or multilateral arrangements.

D. The Board of Governors shall apportion the expenses referred to in sub-paragraph B-1 above, among members in accordance with a scale to be fixed by the General Conference. In fixing the scale the General Conference shall be guided by the principles adopted by the United Nations in assessing contributions of Member States to the regular budget of the United Nations.

E. The Board of Governors shall establish periodically a scale of charges, including reasonable uniform storage and handling charges, for materials, services, equipment, and facilities furnished to members by the Agency. The scale shall be designed to produce revenues for the Agency adequate to meet the expenses and costs referred to in sub-paragraph B-2 above, less any voluntary contributions which the Board of Governors may, in accordance with paragraph F, apply for this purpose. The proceeds of such charges shall be placed in a separate fund which shall be used to pay members for any materials, services, equipment, or facilities furnished by them and to meet other expenses referred to in sub-paragraph B-2 above which may be incurred by the Agency itself.

F. Any excess of revenues referred to in paragraph E over the expenses and costs there referred to, and any voluntary contributions to the Agency, shall be placed in a general fund which may be used as the Board of Governors, with the approval of the General Conference, may determine.

G. Subject to rules and limitations approved by the General Conference, the Board of Governors shall have the authority to exercise borrowing powers on behalf of the Agency without however, imposing on members of the Agency any liability in respect of loans entered into pursuant to this authority, and to accept voluntary contributions made to the Agency.

H. Decisions of the General Conference on financial questions and of the Board of

Governors on the amount of the Agency's budget shall require a two-thirds majority of those present and voting.

ARTICLE XV

Privileges and immunities

A. The Agency shall enjoy in the territory of each member such legal capacity and such privileges and immunities as are necessary for the exercise of its functions.

B. Delegates of members together with their alternates and advisers, Governors appointed to the Board together with their alternates and advisers, and the Director General and the staff of the Agency, shall enjoy such privileges and immunities as are necessary in the independent exercise of their functions in connexion with the Agency.

C. The legal capacity, privileges, and immunities referred to in this article shall be defined in a separate agreement or agreements between the Agency, represented for this purpose by the Director General acting under instructions of the Board of Governots, and the members.

ARTICLE XVI

Relationship with other organizations

A. The Board of Governors, with the approval of the General Conference, is authorized to enter into an agreement or agreements establishing an appropriate relationship between the Agency and the United Nations and any other organizations the work of which is related to that of the Agency.

B. The agreement or agreements establishing the relationship of the Agency and the United Nations shall provide for:

1. Submission by the Agency of reports as provided for in sub-paragraphs B-4 and B-5 of article III;

2. Consideration by the Agency of resolutions relating to it adopted by the General Assembly or any of the Councils of the United Nations and the submission of reports, when requested, to the appropriate organ of the United Nations on the action taken by the Agency or by its members in accordance with this Statute as a result of such consideration.

ARTICLE XVII

Settlement of disputes

A. Any questions or dispute concerning the interpretation or application of this Statute which is not settled by negotiation shall be referred to the International Court of Justice in conformity with the Statute of the Court, unless the parties concerned agree on another mode of settlement.

B. The General Conference and the Board of Governors are separately empowered, subject to authorization from the General Assembly of the United Nations, to request the International Court of Justice to give an advisory opinion on any legal question arising within the scope of the Agency's activities.

ARTICLE XVIII

Amendments and withdrawals

A. Amendments to this Statute may be proposed by any member. Certified copies of the text of any amendment proposed shall be prepared by the Director General and communicated by him to all members at least ninety days in advance of its consideration by the General Conference.

B. At the fifth annual session of the General Conference following the coming into force of this Statute, the question of a general review of the provisions of this Statute shall be placed on the agenda of that session. On approval by a majority of the members present and voting, the review will take place at the following General Conference. Thereafter, proposals on the question of a general review of this Statute may be submitted for decision by the General Conference under the same procedure.

C. Amendments shall come into force for all members when:

(i) Approved by the General Conference by a two-thirds majority of those present and voting after consideration of observations submitted by the Board of Governors on each proposed amendment, and

(ii) Accepted by two-thirds of all the members in accordance with their respective constitutional processes. Acceptance by a member shall be effected by the deposit of an instrument of acceptance with the depository Government referred to in paragraph C of article XXI.

D. At any time after five years from the date when this Statute shall take effect in accordance with paragraph E of article XXI or whenever a member is unwilling to accept an amendment to this Statute, it may withdraw from the Agency by notice in writing to that effect given to the depositary Government referred to in paragraph C of article XXI, which shall promptly inform the Board of Governors and all members.

E. Withdrawal by a member from the Agency shall not affect its contractual obligations entered into pursuant to article XI or its budgetary obligations for the year in which it withdraws.

ARTICLE XIX

Suspension of privileges

A. A member of the Agency which is in arrears in the payment of its financial contributions to the Agency shall have no vote in the Agency if the amount of its arrears equals or exceeds the amount of the contributions due from it for the preceding two years. The General Conference may, nevertheless, permit such a member to vote if it is satisfied that the failure to pay is due to conditions beyond the control of the member.

B. A member which has persistently violated the provisions of this Statute or of any agreement entered into by it pursuant to this Statute may be suspended from the exercise of the privileges and rights of membership by the General Conference acting by a two-thirds majority of the members present and voting upon recommendation by the Board of Governors.

ARTICLE XX

Definitions

As used in this Statute:

1. The term "special fissionable material" means plutonium-239; uranium-233; uranium enriched in the isotopes 235 or 233; any material containing one or more of the foregoing; and such other fissionable material as the Board of Governors shall from time to time determine; but the term "special fissionable material" does not include source material.

2. The term "uranium enriched in the isotopes 235 or 233" means uranium containing the isotopes 235 or 233 or both in an amount such that the abundance ratio of the sum of these isotopes to the isotope 238 is greater than the ratio of the isotope 235 to the isotope 238 occurring in nature.

3. The term "source material" means uranium containing the mixture of isotopes occurring in nature; uranium depleted in the isotope 235; thorium; any of the foregoing in the form of metal, alloy, chemical compound, or concentrate; any other material containing one or more of the foregoing of such concentration as the Board of Governors shall from time to time determine; and such other material as the Board of Governors shall from time to time determine.

ARTICLE XXI

Signature, acceptance, and entry into force

A. This Statute shall be open for signature on 26 October 1956 by all States Members of the United Nations or of any of the specialized agencies and shall remain open for signature by those States for a period of ninety days.

B. The signatory States shall become parties to this Statute by deposit of an instrument of ratification.

C. Instruments of ratification by signatory States and instruments of acceptance by States whose membership has been approved under paragraph B of article IV of this Statute shall be deposited with the Government of the United States of America, hereby designated as depositary Government.

D. Ratification or acceptance of this Statute shall be effected by States in accordance with their respective constitutional processes.

E. This Statute, apart from the Annex, shall come into force when eighteen States have deposited instruments of ratification in accordance with paragraph B of this article, provided that such eighteen States shall include at least three of the following States: Canada, France, the Union of Soviet Socialist Republics, the United Kingdom of Great Britain and Northern Ireland, and the United States of America. Instruments of ratification and instruments of acceptance deposited thereafter shall take effect on the date of their receipt.

F. The depositary Government shall promptly inform all States signatory to this Statute of the date of each deposit of ratification and the date of entry into force of the Statute. The depositary Government shall promptly inform all signatories and members of the dates on which States subsequently become parties thereto.

G. The Annex to this Statute shall come into force on the first day this Statute is open for signature.

ARTICLE XXII

Registration with the United Nations

A. This Statute shall be registered by the depositary Government pursuant to Article 102 of the Charter of the United Nations.

B. Agreements between the Agency and any member or members, agreements between the Agency and any other organization or organizations, and agreements between members subject to approval of the Agency, shall be registered with the Agency. Such agreements shall be registered by the Agency with the United Nations if registration is required under Article 102 of the Charter of the United Nations.

ARTICLE XXIII

Authentic texts and certified copies

This Statute, done in the Chinese, English, French, Russian and Spanish languages, each being equally authentic, shall be deposited in the archives of the depositary Government. Duly certified copies of this Statute shall be transmitted by the depositary Government to the Governments of the other signatory States and to the Governments of States admitted to membership under paragraph B of article IV.

In witness whereof the undersigned, duly authorized, have signed this Statute.

DONE at the Headquarters of the United Nations, this twenty-sixth day of October, one thousand nine hundred and fifty-six.

ANNEX I

Preparatory Commission

A. A Preparatory Commission shall come into existence on the first day this Statute is open for signature. It shall be composed of one representative each of Australia, Belgium, Brazil, Canada, Czechoslovakia, France, India, Portugal, Union of South Africa, Union of Soviet Socialist Republics, United Kingdom of Great Britain and Northern Ireland, and United States of America, and one representative each of six other States to be chosen by the International Conference on the Statute of the International Atomic Energy Agency. The Preparatory Commission shall remain in existence until this Statute comes into force and thereafter until the General Conference has convened and a Board of Governors has been selected in accordance with article VI.

B. The expenses of the Preparatory Commission may be met by a loan provided by the United Nations and for this purpose the Preparatory Commission shall make the necessary arrangements with the appropriate authorities of the United Nations, including arrangements for repayment of the loan by the Agency. Should these funds be insufficient, the Preparatory Commission may accept advances from Governments. Such advances may be set off against the contributions of the Governments concerned to the Agency.

C. The Preparatory Commission shall:

1. Elect its own officers, adopt its own rules of procedure, meet as often as necessary, determine its own place of meeting and establish such committees as it deems necessary;

2. Appoint an executive secretary and staff as shall be necessary, who shall exercise such powers and perform such duties as the Commission may determine;

3. Make arrangements for the first session of the General Conference, including the preparation of a provisional agenda and draft rules of procedure, such session to be held as soon as possible after the entry into force of this Statute;

4. Make designations for membership on the first Board of Governors in accordance with sub-paragraphs A-1 and A-2 and paragraph B of article VI;

5. Make studies, reports, and recommendations for the first session of the General Conference and for the first meeting of the Board of Governors on subjects of concern to the Agency requiring immediate attention, including *(a)* the financing of the Agency; *(b)* the programmes and budget for the first year of the Agency; *(c)* technical problems relevant to advance planning of Agency operations; *(d)* the establishment of a permanent Agency staff; and *(e)* the location of the permanent headquarters of the Agency;

6. Make recommendations for the first meeting of the Board of Governors concerning the provisions of a headquarters agreement defining the status of the Agency and the rights and obligations which will exist in the relationship between the Agency and the host Government;

7. *(a)* Enter into negotiations with the United Nations with a view to the preparation of a draft agreement in accordance with article XVI of this Statute, such draft agreement to be submitted to the first session of the General Conference and to the first meeting of the Board of Governors; and *(b)* make recommendations to the first session of the General Conference and to the first meeting of the Board of Governors concerning the relationship of the Agency to other international organizations as contemplated to article XVI of this Statute.

INF

International Atomic Energy Agency
INFORMATION CIRCULAR

INFCIRC/2/Rev.34
January 1984

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Original: ENGLISH

MEMBERS OF THE AGENCY

On 1 January 1984 the 112 Members of the Agency were as follows:

Afghanistan
Albania
Algeria
Argentina
Australia
Austria
Bangladesh
Belgium
Bolivia
Brazil
Bulgaria
Burma
Byelorussian Soviet
  Socialist Republic
Canada
Chile
China
Colombia
Costa Rica
Cuba
Cyprus
Czechoslovakia
Democratic Kampuchea
Democratic People's
  Republic of Korea
Denmark
Dominican Republic
Ecuador
Egypt
El Salvador
Ethiopia
Finland
France
Gabon
German Democratic
  Republic
Germany, Federal
  Republic of
Ghana
Greece
Guatemala

Haiti
Holy See
Hungary
Iceland
India
Indonesia
Iran, Islamic
  Republic of
Iraq
Ireland
Israel
Italy
Ivory Coast
Jamaica
Japan
Jordan
Kenya
Korea, Republic of
Kuwait
Lebanon
Liberia
Libyan Arab Jamahiriya
Liechtenstein
Luxembourg
Madagascar
Malaysia
Mali
Mauritius
Mexico
Monaco
Mongolia
Morocco
Namibia
Netherlands
New Zealand
Nicaragua
Niger
Nigeria
Norway
Pakistan
Panama

Paraguay
Peru
Philippines
Poland
Portugal
Qatar
Romania
Saudi Arabia
Senegal
Sierra Leone
Singapore
South Africa
Spain
Sri Lanka
Sudan
Sweden
Switzerland
Syrian Arab Republic
Thailand
Tunisia
Turkey
Uganda
Ukrainian Soviet Socialist
  Republic
Union of Soviet Socialist
  Republics
United Arab Emirates
United Kingdom of Great
  Britain and Northern
  Ireland
United Republic of
  Cameroon
United Republic of
  Tanzania
United States of America
Uruguay
Venezuela
Viet Nam
Yugoslavia
Zaire
Zambia

84-0353

Treaty for the Prohibition of Nuclear Weapons in Latin America

OPENED FOR SIGNATURE AT MEXICO CITY: 14 February 1967

ENTERED INTO FORCE: For each Government individually

THE DEPOSITARY GOVERNMENT: Mexico

PREAMBLE

In the name of their peoples and faithfully interpreting their desires and aspirations, the Governments of the States which sign the Treaty for the Prohibition of Nuclear Weapons in Latin America,

Desiring to contribute, so far as lies in their power, towards ending the armaments race, especially in the field of nuclear weapons, and towards strengthening a world at peace, based on the sovereign equality of States, mutual respect and good neighbourliness,

Recalling that the United Nations General Assembly, in its Resolution 808 (IX), adopted unanimously as one of the three points of a coordinated programme of disarmament "the total prohibition of the use and manufacture of nuclear weapons and weapons of mass destruction of every type",

Recalling that militarily denuclearized zones are not an end in themselves but rather a means for achieving general and complete disarmament at a later stage,

Recalling United Nations General Assembly Resolution 1911 (XVIII), which established that the measures that should be agreed upon for the denuclearization of Latin America should be taken "in the light of the principles of the Charter of the United Nations and of regional agreements",

Recalling United Nations General Assembly Resolution 2028 (XX), which established the principle of an acceptable balance of mutual responsibilities and duties for the nuclear and non-nuclear powers, and

Recalling that the Charter of the Organization of American States proclaims that it is an essential purpose of the Organization to strengthen the peace and security of the hemisphere,

Convinced:

That the incalculable destructive power of nuclear weapons has made it imperative that the legal prohibition of war should be strictly observed in practice if the survival of civilization and of mankind itself is to be assured,

That nuclear weapons, whose terrible effects are suffered, indiscriminately and inexorably, by military forces and civilian population alike, constitute, through the persistence of the radioactivity they release, an attack on the integrity of the human species and ultimately may even render the whole earth uninhabitable,

That general and complete disarmament under effective international control is a vital matter which all the peoples of the world equally demand,

That the proliferation of nuclear weapons, which seems inevitable unless States, in the exercise of their sovereign rights, impose restrictions on themselves in order to prevent it, would make any agreement on disarmament enormously difficult and would increase the danger of the outbreak of a nuclear conflagration,

That the establishment of militarily denuclearized zones is closely linked with the maintenance of peace and security in the respective regions,

That the military denuclearization of vast geographical zones, adopted by the sovereign decision of the States comprised therein, will exercise a beneficial influence on other regions where similar conditions exist,

That the privileged situation of the signatory States, whose territories are wholly free from nuclear weapons, imposes upon them the inescapable duty of preserving that situation both in their own interests and for the good of mankind,

That the existence of nuclear weapons in any country of Latin America would make it a target for possible nuclear attacks and would inevitably set off, throughout the region, a ruinous race in nuclear weapons which would involve the unjustifiable diversion, for warlike purposes, of the limited resources required for economic and social development,

That the foregoing reasons, together with the traditional peace-loving outlook of Latin America, give rise to an inescapable necessity that nuclear energy should be used in that region exclusively for peaceful purposes, and that the Latin American countries should use their right to the greatest and most equitable possible access to this new source of energy in order to expedite the economic and social development of their peoples,

Convinced finally:

That the military denuclearization of Latin America—being understood to mean the undertaking entered into internationally in this Treaty to keep their territories forever free from nuclear weapons—will constitute a measure which will spare their peoples from the squandering of their limited resources on nuclear armaments and will protect them against possible nuclear attacks on their territories, and will also constitute a significant contribution towards preventing the proliferation of nuclear weapons and a powerful factor for general and complete disarmament, and

That Latin America, faithful to its tradition of universality, must not only endeavour to banish from its homelands the scourge of a nuclear war, but must also strive to promote the well-being and advancement of its peoples, at the same time co-operating in the fulfilment of the ideals of mankind, that is to say, in the consolidation of a permanent peace based on equal rights, economic fairness and social justice for all, in accordance with the principles and purposes set forth in the Charter of the United Nations and in the Charter of the Organization of American States,

Have agreed as follows:

OBLIGATIONS

Article 1

1. The Contracting Parties hereby undertake to use exclusively for peaceful purposes the nuclear material and facilities which are under their jurisdiction, and to prohibit and prevent in their respective territories:

(*a*) The testing, use, manufacture, production or acquisition by any means whatsoever of any nuclear weapons, by the Parties themselves, directly or indirectly, on behalf of anyone else or in any other way, and

(*b*) The receipt, storage, installation, deployment and any form of possession of any nuclear weapons, directly or indirectly, by the Parties themselves, by anyone on their behalf or in any other way.

2. The Contracting Parties also undertake to refrain from engaging in, encouraging or authorizing, directly or indirectly, or in any way participating in the testing, use, manufacture, production, possession or control of any nuclear weapon.

DEFINITION OF THE CONTRACTING PARTIES

Article 2

For the purposes of this Treaty, the Contracting Parties are those for whom the Treaty is in force.

DEFINITION OF TERRITORY

Article 3

For the purposes of this Treaty, the term "territory" shall include the territorial sea, air space and any other space over which the State exercises sovereignty in accordance with its own legislation.

ZONE OF APPLICATION

Article 4

1. The zone of application of this Treaty is the whole of the territories for which the Treaty is in force.

2. Upon fulfilment of the requirements of article 28, paragraph 1, the zone of application of this Treaty shall also be that which is situated in the western hemisphere within the following limits (except the continental part of the territory of the United States of America and its territorial waters): starting at a point located at 35° north latitude, 75° west longitude; from this point directly southward to a point at 30° north latitude, 75° west longitude; from there, directly eastward to a point at 30° north latitude, 50° west longitude; from there, along a loxodromic line to a point at 5° north latitude, 20° west longitude; from there, directly southward to a point at 60° south latitude, 20° west longitude; from there, directly westward to a point at 60° south latitude, 115° west longitude; from there, directly northward to a point at 0 latitude, 115° west longitude; from there, along a loxodromic line to a point at 35° north latitude, 150° west longitude; from there, directly eastward to a point at 35° north latitude, 75° west longitude.

DEFINITION OF NUCLEAR WEAPONS

Article 5

For the purposes of this Treaty, a nuclear weapon is any device which is capable of releasing nuclear energy in an uncontrolled manner and which has a group of characteristics that are appropriate for use for warlike purposes. An instrument that may be used for the transport or propulsion of the device is not included in this definition if it is separable from the device and not an indivisible part thereof.

MEETING OF SIGNATORIES

Article 6

At the request of any of the signatory States or if the Agency established by article 7 should so decide, a meeting of all the signatories may be convoked to consider in common questions which may affect the very essence of this instrument, including possible amendments to it. In either case, the meeting will be convoked by the General Secretary.

ORGANIZATION

Article 7

1. In order to ensure compliance with the obligations of this Treaty, the Contracting Parties hereby establish an international organization to be known as the Agency for the Prohibition of Nuclear Weapons in Latin America, hereinafter referred to as "the Agency". Only the Contracting Parties shall be affected by its decisions.

2. The Agency shall be responsible for the holding of periodic or extraordinary consultations among Member States on matters relating to the purposes, measures and procedures set forth in this Treaty and to the supervision of compliance with the obligations arising therefrom.

3. The Contracting Parties agree to extend to the Agency full and prompt co-operation in accordance with the provisions of this Treaty, of any agreements they may conclude with the Agency and of any agreements the Agency may conclude with any other international organization or body.

4. The headquarters of the Agency shall be in Mexico City.

ORGANS

Article 8

1. There are hereby established as principal organs of the Agency a General Conference, a Council and a Secretariat.

2. Such subsidiary organs as are considered necessary by the General Conference may be established within the purview of this Treaty.

THE GENERAL CONFERENCE

Article 9

1. The General Conference, the supreme organ of the Agency, shall be composed of all the Contracting Parties; it shall hold regular sessions every two years, and may also hold special sessions whenever this Treaty so provides or, in the opinion of the Council, the circumstances so require.

2. The General Conference:

(*a*) May consider and decide on any matters or questions covered by this Treaty, within the limits thereof, including those referring to powers and functions of any organ provided for in this Treaty;

(*b*) Shall establish procedures for the control system to ensure observance of this Treaty in accordance with its provisions;

(*c*) Shall elect the Members of the Council and the General Secretary;

(*d*) May remove the General Secretary from office if the proper functioning of the Agency so requires;

(*e*) Shall receive and consider the biennial and special reports submitted by the Council and the General Secretary.

(*f*) Shall initiate and consider studies designed to facilitate the optimum fulfilment of the aims of this Treaty, without prejudice to the power of the General Secretary independently to carry out similar studies for submission to and consideration by the Conference.

(*g*) Shall be the organ competent to authorize the conclusion of agreements with Governments and other international organizations and bodies.

3. The General Conference shall adopt the Agency's budget and fix the scale of financial contributions to be paid by Member States, taking into account the systems and criteria used for the same purpose by the United Nations.

4. The General Conference shall elect its officers for each session and may establish such subsidiary organs as it deems necessary for the performance of its functions.

5. Each Member of the Agency shall have one vote. The decisions of the General Conference shall be taken by a two-thirds majority of the Members present and voting in the case of matters relating to the control system and measures referred to in article 20, the admission of new Members, the election or removal of the General Secretary, adoption of the budget and matters related thereto. Decisions on other matters, as well as procedural questions and also determination of which questions must be decided by a two-thirds majority, shall be taken by a simple majority of the Members present and voting.

6. The General Conference shall adopt its own rules of procedure.

THE COUNCIL

Article 10

1. The Council shall be composed of five Members of the Agency elected by the General Conference from among the Contracting Parties, due account being taken of equitable geographic distribution.

2. The Members of the Council shall be elected for a term of four years. However, in the first election three will be elected for two years. Outgoing Members may not be re-elected for the following period unless the limited number of States for which the Treaty is in force so requires.

3. Each Member of the Council shall have one representative.

4. The Council shall be so organized as to be able to function continuously.

5. In addition to the functions conferred upon it by this Treaty and to those which may be assigned to it by the General Conference, the Council shall, through the General Secretary, ensure the proper operation of the control system in accordance with the provisions of this Treaty and with the decisions adopted by the General Conference.

6. The Council shall submit an annual report on its work to the General Conference as well as such special reports as it deems necessary or which the General Conference requests of it.

7. The Council shall elect its officers for each session.

8. The decisions of the Council shall be taken by a simple majority of its Members present and voting.

9. The Council shall adopt its own rules of procedure.

THE SECRETARIAT

Article 11

1. The Secretariat shall consist of a General Secretary, who shall be the chief administrative officer of the Agency, and of such staff as the Agency may require. The term of office of the General Secretary shall be four years and he may be re-elected for a single additional term. The General Secretary may not be a national of the country in which the Agency has its headquarters. In case the office of General Secretary becomes vacant, a new election shall be held to fill the office for the remainder of the term.

2. The staff of the Secretariat shall be appointed by the General Secretary, in accordance with rules laid down by the General Conference.

3. In addition to the functions conferred upon him by this Treaty and to those which may be assigned to him by the General Conference, the General Secretary shall ensure, as provided by article 10, paragraph 5, the proper operation of the control system established by this Treaty, in accordance with the provisions of the Treaty and the decisions taken by the General Conference.

4. The General Secretary shall act in that capacity in all meetings of the General Conference and of the Council and shall make an annual report to both bodies on the work of the Agency and any special reports requested by the General Conference or the Council or which the General Secretary may deem desirable.

5. The General Secretary shall establish the procedures for distributing to all Contracting Parties information received by the Agency from governmental sources and such information from non-governmental sources as may be of interest to the Agency.

6. In the performance of their duties the General Secretary and the staff shall not seek or receive instructions from any Government or from any other authority external to the Agency and shall refrain from any action which might reflect on their position as international officials responsible only to the Agency; subject to their responsibility to the Agency, they shall not disclose any industrial secrets or other confidential information coming to their knowledge by reason of their official duties in the Agency.

7. Each of the Contracting Parties undertakes to respect the exclusively international character of the responsibilities of the General Secretary and the staff and not to seek to influence them in the discharge of their responsibilities.

CONTROL SYSTEM

Article 12

1. For the purpose of verifying compliance with the obligations entered into by the Contracting Parties in accordance with article 1,

a control system shall be established which shall be put into effect in accordance with the provisions of articles 13-18 of this Treaty.

2. The control system shall be used in particular for the purpose of verifying:

(*a*) That devices, services and facilities intended for peaceful uses of nuclear energy are not used in the testing or manufacture of nuclear weapons;

(*b*) That none of the activities prohibited in article 1 of this Treaty are carried out in the territory of the Contracting Parties with nuclear materials or weapons introduced from abroad, and

(*c*) That explosions for peaceful purposes are compatible with article 18 of this Treaty.

IAEA SAFEGUARDS

Article 13

Each Contracting Party shall negotiate multilateral or bilateral agreements with the International Atomic Energy Agency for the application of its safeguards to its nuclear activities. Each Contracting Party shall initiate negotiations within a period of 180 days after the date of the deposit of its instrument of ratification of this Treaty. These agreements shall enter into force, for each Party, not later than eighteen months after the date of the initiation of such negotiations except in case of unforeseen circumstances or *force majeure*.

REPORTS OF THE PARTIES

Article 14

1. The Contracting Parties shall submit to the Agency and to the International Atomic Energy Agency, for their information, semi-annual reports stating that no activity prohibited under this Treaty has occurred in their respective territories.

2. The Contracting Parties shall simultaneously transmit to the Agency a copy of any report they may submit to the International Atomic Energy Agency which relates to matters that are the subject of this Treaty and to the application of safeguards.

3. The Contracting Parties shall also transmit to the Organization of American States, for its information, any reports that may be of interest to it, in accordance with the obligations established by the Inter-American System.

SPECIAL REPORTS REQUESTED BY THE GENERAL SECRETARY

Article 15

1. With the authorization of the Council, the General Secretary may request any of the Contracting Parties to provide the Agency

with complementary or supplementary information regarding any event or circumstance connected with compliance with this Treaty, explaining his reasons. The Contracting Parties undertake to co-operate promptly and fully with the General Secretary.

2. The General Secretary shall inform the Council and the Contracting Parties forthwith of such requests and of the respective replies.

SPECIAL INSPECTIONS

Article 16

1. The International Atomic Energy Agency and the Council established by this Treaty have the power of carrying out special inspections in the following cases:

(*a*) In the case of the International Atomic Energy Agency, in accordance with the agreements referred to in article 13 of this Treaty;

(*b*) In the case of the Council:

(i) When so requested, the reasons for the request being stated, by any Party which suspects that some activity prohibited by this Treaty has been carried out or is about to be carried out, either in the territory of any other Party or in any other place on such latter Party's behalf, the Council shall immediately arrange for such an inspection in accordance with article 10, paragraph 5;

(ii) When requested by any Party which has been suspected of or charged with having violated this Treaty, the Council shall immediately arrange for the special inspection requested in accordance with article 10, paragraph 5.

The above requests will be made to the Council through the General Secretary.

2. The costs and expenses of any special inspection carried out under paragraph 1, subparagraph (*b*), sections (i) and (ii) of this article shall be borne by the requesting Party or Parties, except where the Council concludes on the basis of the report on the special inspection that, in view of the circumstances existing in the case, such costs and expenses should be borne by the Agency.

3. The General Conference shall formulate the procedures for the organization and execution of the special inspections carried out in accordance with paragraph 1, subparagraph (*b*), sections (i) and (ii) of this article.

4. The Contracting Parties undertake to grant the inspectors carrying out such special inspections full and free access to all places and all information which may be necessary for the performance of their duties and which are directly and intimately connected with the

suspicion of violation of this Treaty. If so requested by the authorities of the Contracting Party in whose territory the inspection is carried out, the inspectors designated by the General Conference shall be accompanied by representatives of said authorities, provided that this does not in any way delay or hinder the work of the inspectors.

5. The Council shall immediately transmit to all the Parties, through the General Secretary, a copy of any report resulting from special inspections.

6. Similarly, the Council shall send through the General Secretary to the Secretary-General of the United Nations, for transmission to the United Nations Security Council and General Assembly, and to the Council of the Organization of American States, for its information, a copy of any report resulting from any special inspection carried out in accordance with paragraph 1, subparagraph (*b*), sections (i) and (ii) of this article.

7. The Council may decide, or any Contracting Party may request, the convening of a special session of the General Conference for the purpose of considering the reports resulting from any special inspection. In such a case, the General Secretary shall take immediate steps to convene the special session requested.

8. The General Conference, convened in special session under this article, may make recommendations to the Contracting Parties and submit reports to the Secretary-General of the United Nations to be transmitted to the United Nations Security Council and the General Assembly.

USE OF NUCLEAR ENERGY FOR PEACEFUL PURPOSES

Article 17

Nothing in the provisions of this Treaty shall prejudice the rights of the Contracting Parties, in conformity with this Treaty, to use nuclear energy for peaceful purposes, in particular for their economic development and social progress.

EXPLOSIONS FOR PEACEFUL PURPOSES

Article 18

1. The Contracting Parties may carry out explosions of nuclear devices for peaceful purposes—including explosions which involve devices similar to those used in nuclear weapons—or collaborate with third parties for the same purpose, provided that they do so in accordance with the provisions of this article and the other articles of the Treaty, particularly articles 1 and 5.

2. Contracting Parties intending to carry out, or to co-operate in carrying out, such an explosion shall notify the Agency and the

International Atomic Energy Agency, as far in advance as the circumstances require, of the date of the explosion and shall at the same time provide the following information:

(*a*) The nature of the nuclear device and the source from which it was obtained;

(*b*) The place and purpose of the planned explosion;

(*c*) The procedures which will be followed in order to comply with paragraph 3 of this article;

(*d*) The expected force of the device, and

(*e*) The fullest possible information on any possible radioactive fall-out that may result from the explosion or explosions, and measures which will be taken to avoid danger to the population, flora, fauna and territories of any other Party or Parties.

3. The General Secretary and the technical personnel designated by the Council and the International Atomic Energy Agency may observe all the preparations, including the explosion of the device, and shall have unrestricted access to any area in the vicinity of the site of the explosion in order to ascertain whether the device and the procedures followed during the explosion are in conformity with the information supplied under paragraph 2 of this article and the other provisions of this Treaty.

4. The Contracting Parties may accept the collaboration of third parties for the purpose set forth in paragraph 1 of the present article, in accordance with paragraphs 2 and 3 thereof.

RELATIONS WITH OTHER INTERNATIONAL ORGANIZATIONS

Article 19

1. The Agency may conclude such agreements with the International Atomic Energy Agency as are authorized by the General Conference and as it considers likely to facilitate the efficient operation of the control system established by this Treaty.

2. The Agency may also enter into relations with any international organization or body, especially any which may be established in the future to supervise disarmament or measures for the control of armaments in any part of the world.

3. The Contracting Parties may, if they see fit, request the advice of the Inter-American Nuclear Energy Commission on all technical matters connected with the application of this Treaty with which the Commission is competent to deal under its Statute.

MEASURES IN THE EVENT OF VIOLATION OF THE TREATY

Article 20

1. The General Conference shall take note of all cases in which, in its opinion, any Contracting Party is not complying fully with its

obligations under this Treaty and shall draw the matter to the attention of the Party concerned, making such recommendations as it deems appropriate.

2. If, in its opinion, such non-compliance constitutes a violation of this Treaty which might endanger peace and security, the General Conference shall report thereon simultaneously to the United Nations Security Council and the General Assembly through the Secretary-General of the United Nations, and to the Council of the Organization of American States. The General Conference shall likewise report to the International Atomic Energy Agency for such purposes as are relevant in accordance with its Statute.

UNITED NATIONS AND ORGANIZATION OF AMERICAN STATES

Article 21

None of the provisions of this Treaty shall be construed as impairing the rights and obligations of the Parties under the Charter of the United Nations or, in the case of States Members of the Organization of American States, under existing regional treaties.

PRIVILEGES AND IMMUNITIES

Article 22

1. The Agency shall enjoy in the territory of each of the Contracting Parties such legal capacity and such privileges and immunities as may be necessary for the exercise of its functions and the fulfilment of its purposes.

2. Representatives of the Contracting Parties accredited to the Agency and officials of the Agency shall similarly enjoy such privileges and immunities as are necessary for the performance of their functions.

3. The Agency may conclude agreements with the Contracting Parties with a view to determining the details of the application of paragraphs 1 and 2 of this article.

NOTIFICATION OF OTHER AGREEMENTS

Article 23

Once this Treaty has entered into force, the Secretariat shall be notified immediately of any international agreement concluded by any of the Contracting Parties on matters with which this Treaty is concerned; the Secretariat shall register it and notify the other Contracting Parties.

SETTLEMENT OF DISPUTES

Article 24

Unless the Parties concerned agree on another mode of peaceful settlement, any question or dispute concerning the interpretation or application of this Treaty which is not settled shall be referred to the International Court of Justice with the prior consent of the Parties to the controversy.

Signature

Article 25

1. This Treaty shall be open indefinitely for signature by:

(*a*) All the Latin American Republics, and

(*b*) All other sovereign States situated in their entirety south of latitude 35° north in the western hemisphere; and, except as provided in paragraph 2 of this article, all such States which become sovereign, when they have been admitted by the General Conference.

2. The General Conference shall not take any decision regarding the admission of a political entity part or all of whose territory is the subject, prior to the date when this Treaty is opened for signature, of a dispute or claim between an extra-continental country and one or more Latin American States, so long as the dispute has not been settled by peaceful means.

Ratification and deposit

Article 26

1. This Treaty shall be subject to ratification by signatory States in accordance with their respective constitutional procedures.

2. This Treaty and the instruments of ratification shall be deposited with the Government of the Mexican United States, which is hereby designated the Depositary Government.

3. The Depositary Government shall send certified copies of this Treaty to the Governments of signatory States and shall notify them of the deposit of each instrument of ratification.

Reservations

Article 27

This Treaty shall not be subject to reservations.

Entry into force

Article 28

1. Subject to the provisions of paragraph 2 of this article, this Treaty shall enter into force among the States that have ratified it as soon as the following requirements have been met:

(*a*) Deposit of the instruments of ratification of this Treaty with the Depositary Government by the Governments of the States mentioned in article 25 which are in existence on the date when this

Treaty is opened for signature and which are not affected by the provisions of article 25, paragraph 2;

(*b*) Signature and ratification of Additional Protocol I annexed to this Treaty by all extra-continental or continental States having *de jure* or *de facto* international responsibility for territories situated in the zone of application of the Treaty;

(*c*) Signature and ratification of the Additional Protocol II annexed to this Treaty by all powers possessing nuclear weapons;

(*d*) Conclusion of bilateral or multilateral agreements on the application of the Safeguards System of the International Atomic Energy Agency in accordance with article 13 of this Treaty.

2. All signatory States shall have the imprescriptible right to waive, wholly or in part, the requirements laid down in the preceding paragraph. They may do so by means of a declaration which shall be annexed to their respective instrument of ratification and which may be formulated at the time of deposit of the instrument or subsequently. For those States which exercise this right, this Treaty shall enter into force upon deposit of the declaration, or as soon as those requirements have been met which have not been expressly waived.

3. As soon as this Treaty has entered into force in accordance with the provisions of paragraph 2 for eleven States, the Depositary Government shall convene a preliminary meeting of those States in order that the Agency may be set up and commence its work.

4. After the entry into force of this Treaty for all the countries of the zone, the rise of a new power possessing nuclear weapons shall have the effect of suspending the execution of this Treaty for those countries which have ratified it without waiving requirements of paragraph 1, subparagraph (*c*) of this article, and which request such suspension; the Treaty shall remain suspended until the new power, on its own initiative or upon request by the General Conference, ratifies the annexed Additional Protocol II.

AMENDMENTS

Article 29

1. Any Contracting Party may propose amendments to this Treaty and shall submit its proposals to the Council through the General Secretary, who shall transmit them to all the other Contracting Parties and, in addition, to all other signatories in accordance with article 6. The Council, through the General Secretary, shall immediately following the meeting of signatories convene a special session of the General Conference to examine the proposals made, for the adoption of which a two-thirds majority of the Contracting Parties present and voting shall be required.

2. Amendments adopted shall enter into force as soon as the requirements set forth in article 28 of this Treaty have been complied with.

DURATION AND DENUNCIATION

Article 30

1. This Treaty shall be of a permanent nature and shall remain in force indefinitely, but any Party may denounce it by notifying the General Secretary of the Agency if, in the opinion of the denouncing State, there have arisen or may arise circumstances connected with the content of this Treaty or of the annexed Additional Protocols I and II which affect its supreme interests or the peace and security of one or more Contracting Parties.

2. The denunciation shall take effect three months after the delivery to the General Secretary of the Agency of the notification by the Government of the signatory State concerned. The General Secretary shall immediately communicate such notification to the other Contracting Parties and to the Secretary-General of the United Nations for the information of the United Nations Security Council and the General Assembly. He shall also communicate it to the Secretary-General of the Organization of American States.

AUTHENTIC TEXTS AND REGISTRATION

Article 31

This Treaty, of which the Spanish, Chinese, English, French, Portuguese and Russian texts are equally authentic, shall be registered by the Depositary Government in accordance with article 102 of the United Nations Charter. The Depositary Government shall notify the Secretary-General of the United Nations of the signatures, ratifications and amendments relating to this Treaty and shall communicate them to the Secretary-General of the Organization of American States for its information.

Transitional Article

Denunciation of the declaration referred to in article 28, paragraph 2, shall be subject to the same procedures as the denunciation of this Treaty, except that it will take effect on the date of delivery of the respective notification.

IN WITNESS WHEREOF the undersigned Plenipotentiaries, having deposited their full powers, found in good and due form, sign this Treaty on behalf of their respective Governments.

DONE at Mexico, Distrito Federal, on the Fourteenth day of February, one thousand nine hundred and sixty-seven.

Additional Protocol I

The undersigned Plenipotentiaries, furnished with full powers by their respective Governments, Convinced that the Treaty for the Prohibition of Nuclear Weapons in Latin America, negotiated and signed in accordance with the recommendations of the General Assembly of the United Nations in Resolution 1911 (XVIII) of 27 November 1963, represents an important step towards ensuring the non-proliferation of nuclear weapons,

Aware that the non-proliferation of nuclear weapons is not an end in itself but, rather, a means of achieving general and complete disarmament at a later stage, and

Desiring to contribute, so far as lies in their power, towards ending the armaments race, especially in the field of nuclear weapons, and towards strengthening a world peace, based on mutual respect and sovereign equality of States,

Have agreed as follows:

Article 1

To undertake to apply the statute of denuclearization in respect of warlike purposes as defined in articles 1, 3, 5 and 13 of the Treaty for the Prohibition of Nuclear Weapons in Latin America in territories for which, *de jure* or *de facto*, they are internationally responsible and which lie within the limits of the geographical zone established in that Treaty.

Article 2

The duration of this Protocol shall be the same as that of the Treaty for the Prohibition of Nuclear Weapons in Latin America of which this Protocol is an annex, and the provisions regarding ratification and denunciation contained in the Treaty shall be applicable to it.

Article 3

This Protocol shall enter into force, for the States which have ratified it, on the date of the deposit of their respective instruments of ratification.

In witness whereof the undersigned Plenipotentiaries, having deposited their full powers, found in good and due form, sign this Protocol on behalf of their respective Governments.

Additional Protocol II

The undersigned Plenipotentiaries, furnished with full powers by their respective Governments,

Convinced that the Treaty for the Prohibition of Nuclear Weapons in Latin America, negotiated and signed in accordance with the recommendations of the General Assembly of the United Nations in Resolution 1911 (XVIII) of 27 November 1963, represents an important step towards ensuring the non-proliferation of nuclear weapons,

Aware that the non-proliferation of nuclear weapons is not an end in itself but, rather, a means of achieving general and complete disarmament at a later stage, and

Desiring to contribute, so far as lies in their power, towards ending the armaments race, especially in the field of nuclear weapons, and towards promoting and strengthening a world at peace, based on mutual respect and sovereign equality of States,

Have agreed as follows:

Article 1

The statute of denuclearization of Latin America in respect of warlike purposes, as defined, delimited and set forth in the Treaty for the Prohibition of Nuclear Weapons in Latin America of which this instrument is an annex, shall be fully respected by the Parties to this Protocol in all its express aims and provisions.

Article 2

The Governments represented by the undersigned Plenipotentiaries undertake, therefore, not to contribute in any way to the performance of acts involving a violation of the obligations of article 1 of the Treaty in the territories to which the Treaty applies in accordance with article 4 thereof.

Article 3

The Governments represented by the undersigned Plenipotentiaries also undertake not to use or threaten to use nuclear weapons against the Contracting Parties of the Treaty for the Prohibition of Nuclear Weapons in Latin America.

Article 4

The duration of this Protocol shall be the same as that of the Treaty for the Prohibition of Nuclear Weapons in Latin America of which this Protocol is an annex, and the definitions of territory and nuclear weapons set forth in articles 3 and 5 of the Treaty shall be applicable to this Protocol, as well as the provisions regarding ratification, reservations, denunciation, authentic texts and registration contained in articles 26, 27, 30 and 31 of the Treaty.

Article 5

This Protocol shall enter into force, for the States which have ratified it, on the date of the deposit of their respective instruments of ratification.

IN WITNESS WHEREOF, the undersigned Plenipotentiaries, having deposited their full powers, found to be in good and due form, hereby sign this Additional Protocol on behalf of their respective Governments.

STATES THAT HAVE SIGNED OR RATIFIED THE TREATY FOR THE PROHIBITION OF NUCLEAR WEAPONS IN LATIN AMERICA

Country	Date of Signature	Date of Deposit of Ratification
Antigua and Barbuda	10/11/83	10/11/83
Argentina	9/27/67	
Bahamas, The	7/16/76 1/	
Barbados	10/18/68	4/25/69
Bolivia	2/14/67	2/18/69
Brazil	5/9/67	1/29/68 2/
Chile	2/14/67	10/9/74 2/
Colombia	2/14/67	8/4/72
Costa Rica	2/14/67	8/25/69
Dominican Republic	7/29/67	6/14/68
Ecuador	2/14/67	2/11/69
El Salvador	2/14/67	4/22/68
Grenada	4/29/75	6/20/75
Guatemala	2/14/67	2/6/70
Haiti	2/14/67	5/23/69
Honduras	2/14/67	9/23/68
Jamaica	10/26/67	6/26/69
Mexico	2/14/67	9/20/67
Nicaragua	2/15/67	10/24/68
Panama	2/14/67	6/11/71
Paraguay	4/26/67	3/19/69
Peru	2/14/67	3/4/69
Suriname	2/13/76	6/10/77
Trinidad and Tobago	6/27/67	12/3/70 3/
Uruguay	2/14/67	8/20/68
Venezuela	2/14/67	3/23/70

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1 This is date of notification of succession. The declaration of waiver was deposited 4/26/77, which is date of entry into force for The Bahamas.

2 Not in force. No declaration of waiver under Art. 28, para. 2.

3 The declaration of waiver was deposited 6/27/75, which is date of entry into force for Trinidad and Tobago.

Source: U.S. Department of State, Office of the Legal Adviser, May 1985.

STATES THAT HAVE SIGNED Additional Protocol I to the Treaty for The Prohibition of Nuclear Weapons in Latin America

Country	Date of Signature	Date of Deposit of Ratification
France	3/2/79	
Netherlands	4/1/68	7/26/71
United Kingdom	12/20/67	12/11/69
United States	5/26/77	11/23/81

STATES THAT HAVE SIGNED Additional Protocol II to the Treaty for The Prohibition of Nuclear Weapons in Latin America

Country	Date of Signature	Date of Deposit of Ratification
China	8/21/73	6/12/74
France	7/18/83	3/22/74
USSR	5/18/78	1/8/79
United Kingdom	12/20/67	12/11/69
United States	4/1/68	5/12/71

Source: U.S. Department of State, Office of the Legal Adviser, May 1985.

Treaty on the Non-Proliferation of Nuclear Weapons

Opened for signature at London, Moscow and Washington: 1 July 1968

Entered into force: 5 March 1970

The depositary Governments: The Union of Soviet Socialist Republics, the United Kingdom of Great Britain and Northern Ireland and the United States of America

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The States concluding this Treaty, hereinafter referred to as the "Parties to the Treaty",

Considering the devastation that would be visited upon all mankind by a nuclear war and the consequent need to make every effort to avert the danger of such a war and to take measures to safeguard the security of peoples,

Believing that the proliferation of nuclear weapons would seriously enhance the danger of nuclear war,

In conformity with resolutions of the United Nations General Assembly calling for the conclusion of an agreement on the prevention of wider dissemination of nuclear weapons,

Undertaking to co-operate in facilitating the application of International Atomic Energy Agency safeguards on peaceful nuclear activities,

Expressing their support for research, development and other efforts to further the application, within the framework of the International Atomic Energy Agency safeguards system, of the principle of safeguarding effectively the flow of source and special fissionable materials by use of instruments and other techniques at certain strategic points,

Affirming the principle that the benefits of peaceful applications of nuclear technology, including any technological by-products which may be derived by nuclear-weapon States from the development of nuclear explosive devices, should be available for peaceful purposes to all Parties to the Treaty, whether nuclear-weapon or non-nuclear-weapon States, Convinced that, in furtherance of this principle, all Parties to the Treaty are entitled to participate in the fullest possible exchange of scientific information for, and to contribute alone or in co-operation with other States to, the further development of the applications of atomic energy for peaceful purposes,

Declaring their intention to achieve at the earliest possible date the cessation of the nuclear arms race and to undertake effective measures in the direction of nuclear disarmament,

Urging the co-operation of all States in the attainment of this objective,

Recalling the determination expressed by the Parties to the 1963 Treaty banning nuclear weapons tests in the atmosphere, in outer space and under water in its Preamble to seek to achieve the discontinuance of all test explosions of nuclear weapons for all time and to continue negotiations to this end,

Desiring to further the easing of international tension and the strengthening of trust between States in order to facilitate the cessation of the manufacture of nuclear weapons, the liquidation of all their existing stockpiles, and the elimination from national arsenals of nuclear weapons and the means of their delivery pursuant to a Treaty on general and complete disarmament under strict and effective international control,

Recalling that, in accordance with the Charter of the United Nations, States must refrain in their international relations from the threat or use of force against the territorial integrity or political independence of any State, or in any other manner inconsistent with the Purposes of the United Nations, and that the establishment and maintenance of international peace and security are to be promoted with the least diversion for armaments of the world's human and economic resources,

Have agreed as follows:

Article I

Each nuclear-weapon State Party to the Treaty undertakes not to transfer to any recipient whatsoever nuclear weapons or other nuclear explosive devices or control over such weapons or explosive devices directly, or indirectly; and not in any way to assist, encourage, or induce any non-nuclear-weapon State to manufacture or otherwise acquire nuclear weapons or other nuclear explosive devices, or control over such weapons or explosive devices.

Article II

Each non-nuclear-weapon State Party to the Treaty undertakes not to receive the transfer from any transferor whatsoever of nuclear weapons or other nuclear explosive devices or of control over such weapons or explosive devices directly, or indirectly; not to manufacture or otherwise acquire nuclear weapons or other nuclear explosive devices; and not to seek or receive any assistance in the manufacture of nuclear weapons or other nuclear explosive devices.

Article III

1. Each non-nuclear-weapon State Party to the Treaty undertakes to accept safeguards, as set forth in an agreement to be negotiated and concluded with the International Atomic Energy Agency in accordance with the Statute of the International Atomic Energy Agency and the Agency's safeguards system, for the exclusive purpose of verification of the fulfilment of its obligations assumed under this Treaty with a view to preventing diversion of nuclear energy from peaceful uses to nuclear weapons or other nuclear explosive devices. Procedures for the safeguards required by this Article shall be followed with respect to source or special fissionable material whether it is being produced, processed or used in any principal nuclear facility or is outside any such facility. The safeguards required by this Article shall be applied on all source or special fissionable material in all peaceful nuclear activities within the territory of such State, under its jurisdiction, or carried out under its control anywhere.

2. Each State Party to the Treaty undertakes not to provide: (*a*) source or special fissionable material, or (*b*) equipment or material especially designed or prepared for the processing, use or production of special fissionable material, to any non-nuclear-weapon State for peaceful purposes, unless the source or special fissionable material shall be subject to the safeguards required by this Article.

3. The safeguards required by this Article shall be implemented in a manner designed to comply with Article IV of this Treaty, and to avoid hampering the economic or technological development of the Parties or international co-operation in the field of peaceful nuclear activities, including the international exchange of nuclear material and equipment for the processing, use or production of nuclear material for peaceful purposes in accordance with the provisions of this Article and the principle of safeguarding set forth in the *Preamble* of the Treaty.

4. Non-nuclear-weapon States Party to the Treaty shall conclude agreements with the International Atomic Energy Agency to meet the requirements of this Article either individually or together with other States in accordance with the Statute of the International Atomic Energy Agency. Negotiation of such agreements shall commence within 180 days from the original entry into force of this Treaty. For States depositing their instruments of ratification or accession after the 180-day period, negotiation of such agreements shall commence not later than the date of such deposit. Such agreements shall enter into force not later than eighteen months after the date of initiation of negotiations.

Article IV

1. Nothing in this Treaty shall be interpreted as affecting the inalienable right of all the Parties to the Treaty to develop research, production and use of nuclear energy for peaceful purposes without discrimination and in conformity with Articles I and II of this Treaty.

2. All the Parties to the Treaty undertake to facilitate, and have the right to participate in, the fullest possible exchange of equipment, materials and scientific and technological information for the peaceful uses of nuclear energy. Parties to the Treaty in a position to do so shall also co-operate in contributing alone or together with other States or international organizations to the further development of the applications of nuclear energy for peaceful purposes, especially in the territories of non-nuclear-weapon States Party to the Treaty, with due consideration for the needs of the developing areas of the world.

Article V

Each Party to the Treaty undertakes to take appropriate measures to ensure that, in accordance with this Treaty, under appropriate international observation and through appropriate international procedures, potential benefits from any peaceful applications of nuclear explosions will be made available to non-nuclear-weapon States Party to the Treaty on a non-discriminatory basis and that the charge to such Parties for the explosive devices used will be as low as possible and exclude any charge for research and development. Non-nuclear-weapon States Party to the Treaty shall be able to obtain such benefits, pursuant to a special international agreement or agreements, through an appropriate international body with adequate representation of non-nuclear-weapon States. Negotiations on this subject shall commence as soon as possible after the Treaty enters into force. Non-nuclear-weapon States Party to the Treaty so desiring may also obtain such benefits pursuant to bilateral agreements.

Article VI

Each of the Parties to the Treaty undertakes to pursue negotiations in good faith on effective measures relating to cessation of the nuclear arms race at an early date and to nuclear disarmament, and on a treaty on general and complete disarmament under strict and effective international control.

Article VII

Nothing in this Treaty affects the right of any group of States to conclude regional treaties in order to assure the total absence of nuclear weapons in their respective territories.

Article VIII

1. Any Party to the Treaty may propose amendments to this Treaty. The text of any proposed amendment shall be submitted to the Depositary Governments which shall circulate it to all Parties to the Treaty. Thereupon, if requested to do so by one-third or more of the Parties to the Treaty, the Depositary Governments shall convene a conference, to which they shall invite all the Parties to the Treaty, to consider such an amendment.

2. Any amendment to this Treaty must be approved by a majority of the votes of all the Parties to the Treaty, including the votes of all nuclear-weapon States Party to the Treaty and all other Parties which, on the date the amendment is circulated, are members of the Board of Governors of the International Atomic Energy Agency. The amendment shall enter into force for each Party that deposits its instrument of ratification of the amendment upon the deposit of such instruments of ratification by a majority of all the Parties, including the instruments of ratification of all nuclear-weapon States Party to the Treaty and all other Parties which, on the date the amendment is circulated, are members of the Board of Governors of the International Atomic Energy Agency. Thereafter, it shall enter into force for any other Party upon the deposit of its instrument of ratification of the amendment.

3. Five years after the entry into force of this Treaty, a conference of Parties to the Treaty shall be held in Geneva, Switzerland, in order to review the operation of this Treaty with a view to assuring that the purposes of the Preamble and the provisions of the Treaty are being realised. At intervals of five years thereafter, a majority of the Parties to the Treaty may obtain, by submitting a proposal to this effect to the Depositary Governments, the convening of further conferences with the same objective of reviewing the operation of the Treaty.

Article IX

1. This Treaty shall be open to all States for signature. Any State which does not sign the Treaty before its entry into force in accordance with paragraph 3 of this Article may accede to it at any time.

2. This Treaty shall be subject to ratification by signatory States. Instruments of ratification and instruments of accession shall be deposited with the Governments of the United Kingdom of Great Britain and Northern Ireland, the Union of Soviet Socialist Republics and the United States of America, which are hereby designated the Depositary Governments.

3. This Treaty shall enter into force after its ratification by the States, the Governments of which are designated Depositaries of the Treaty, and forty other States signatory to this Treaty and the deposit

of their instruments of ratification. For the purposes of this Treaty, a nuclear-weapon State is one which has manufactured and exploded a nuclear weapon or other nuclear explosive device prior to 1 January, 1967.

4. For States whose instruments of ratification or accession are deposited subsequent to the entry into force of this Treaty, it shall enter into force on the date of the deposit of their instruments of ratification or accession.

5. The Depositary Governments shall promptly inform all signatory and acceding States of the date of each signature, the date of deposit of each instrument of ratification or of accession, the date of the entry into force of this Treaty, and the date of receipt of any requests for convening a conference or other notices.

6. This Treaty shall be registered by the Depositary Governments pursuant to Article 102 of the Charter of the United Nations.

Article X

1. Each Party shall in exercising its national sovereignty have the right to withdraw from the Treaty if it decides that extraordinary events, related to the subject matter of this Treaty, have jeopardized the supreme interests of its country. It shall give notice of such withdrawal to all other Parties to the Treaty and to the United Nations Security Council three months in advance. Such notice shall include a statement of the extraordinary events it regards as having jeopardized its supreme interests.

2. Twenty-five years after the entry into force of the Treaty, a conference shall be convened to decide whether the Treaty shall continue in force indefinitely, or shall be extended for an additional fixed period or periods. This decision shall be taken by a majority of the Parties to the Treaty.

Article XI

This Treaty, the English, Russian, French, Spanish and Chinese texts of which are equally authentic, shall be deposited in the archives of the Depositary Governments. Duly certified copies of this Treaty shall be transmitted by the Depositary Governments to the Governments of the signatory and acceding States.

IN WITNESS WHEREOF the undersigned, duly authorized, have signed this Treaty.

DONE in triplicate, at the cities of London, Moscow and Washington, the first day of July, one thousand nine hundred and sixty-eight.

STATES THAT HAVE SIGNED, RATIFIED OR ACCEDED TO THE NON-PROLIFERATION TREATY

Country	Date of Signature	Date of Deposit of Ratification	Date of Deposit of Accession(A) or Successions(S)
Afghanistan	7/1/68	2/4/70 1/	
Antigua and Barbuda			11/4/81 4/
Australia	2/27/70	1/23/73	
Austria	7/1/68	6/27/69	
Bahamas, The			8/11/76(S)
Bangladesh			8/31/79(A)
Barbados	7/1/68	2/21/80	
Belgium	8/20/68	5/2/75	
Belize			9/29/82 4/
Benin	7/1/68	10/31/72	
Bhutan			5/23/85(A)
Bolivia	7/1/68	5/26/70	
Botswana	7/1/68	4/28/69	
Brunei			3/26/85(A)
Bulgaria	7/1/68	9/5/69	
Burkina Faso	11/25/68	3/3/70	
Burundi			3/19/71(A)
Cameroon	7/17/68	1/8/69	
Canada	7/23/68	1/8/69	
Cape Verde			10/24/79(A)
Central African Republic			10/25/70(A)
Chad	7/1/68	3/10/71	
Colombia	7/1/68		
Congo			10/23/78(A)
Costa Rica	7/1/68	3/3/70	
Cyprus	7/1/68	2/10/70	
Czechoslovakia	7/1/68	7/22/69	
Denmark	7/1/68	1/3/69	
Dominica			8/10/84(S)
Dominican Republic	7/1/68	7/24/71	
Ecuador	7/9/68	3/7/69	
Egypt	7/1/68	2/26/81 1/	
El Salvador	7/1/68	7/11/72	
Equatorial Guinea			11/1/84(A)
Ethiopia	9/5/68	2/5/70	
Fiji			7/14/72(S)
Finland	7/1/68	2/5/69	
Gabon			2/19/74(A)
Gambia, The	9/4/68	5/12/75	
German Democratic Republic	7/1/68	10/31/69	
Germany, Federal Republic of	11/28/69	5/2/75 1/ 2/	

Country	Date of Signature	Date of Deposit of Ratification	Date of Deposit of Accession (A) or Successions(S)
Ghana	7/1/68	5/4/70	
Greece	7/1/68	3/11/70	
Grenada			9/2/75(S)
Guatemala	7/26/68	9/22/70	
Guinea			4/29/85(A)
Guinea-Bissau			8/20/76(A)
Haiti	7/1/68	6/2/70	
Holy See			2/25/71(A) 1/
Honduras	7/1/68	5/16/73	
Hungary	7/1/68	5/27/69	
Iceland	7/1/68	7/18/69	
Indonesia	3/2/70	7/12/79 1/	
Iran	7/1/68	2/2/70	
Iraq	7/1/68	10/29/69	
Ireland	7/1/68	7/1/68	
Italy	1/28/69	5/2/75 1/	
Ivory Coast	7/1/68	3/6/73	
Jamaica	4/14/69	3/5/70	
Japan	2/3/70	6/8/76 1/	
Jordan	7/10/68	2/11/70	
Kampuchea			6/2/72(A)
Kenya	7/1/68	6/11/70	
Kiribati			9/11/79 4/
Korea, Republic of	7/1/68	4/23/75	
Kuwait	8/15/68		
Laos	7/1/68	2/20/70	
Lebanon	7/1/68	7/15/70	
Lesotho	7/9/68	5/20/70	
Liberia	7/1/68	3/5/70	
Libya	7/18/68	5/26/75	
Liechtenstein			4/20/78(A) 1/
Luxembourg	8/14/68	5/2/75	
Madagascar	8/22/68	10/8/70	
Malaysia	7/1/68	3/5/70	
Maldives	9/11/68	4/7/70	
Mali	7/14/69	2/10/70	
Malta	4/17/69	2/6/70	
Mauritius	7/1/68	4/8/69	
Mexico	7/26/68	1/21/69 1/	

Country	Date of Signature	Date of Deposit of Ratification	Date of Deposit of Accession (A) or Succession(S)
Mongolia	7/1/68	5/14/69	
Morocco	7/1/68	11/27/70	
Nauru			6/7/82(A)
Nepal	7/1/68	1/5/70	
Netherlands	8/20/68	5/2/75 3/	
New Zealand	7/1/68	9/10/69	
Nicaragua	7/1/68	3/6/73	
Nigeria	7/1/68	9/27/68	
Norway	7/1/68	2/5/69	
Panama	7/1/68	1/13/77	
Papua New Guinea			1/13/82(A)
Paraguay	7/1/68	2/4/70	
Peru	7/1/68	3/3/70	
Philippines	7/1/68	10/5/72	
Poland	7/1/68	6/12/69	
Portugal			12/15/77(A)
Romania	7/1/68	2/4/70	
Rwanda			5/20/75(A)
San Marino	7/1/68	08/10/70	
Sao Tome and Principe			7/20/83(A)
St. Lucia			12/28/79(S)
St. Christopher and Nevis			11/2/83 4/
St. Vincent and the Grenadines			11/6/84(S)
Senegal	7/1/68	12/17/70	
Seychelles			4/8/85(A)
Sierra Leone			2/26/75(A)
Singapore	2/5/70	3/10/76	
Solomon Islands			6/17/81(S)
Somalia	7/1/68	3/5/70	
Sri Lanka	7/1/68	3/5/79	
Sudan	12/24/68	10/31/73	
Suriname			6/30/76(S)
Swaziland	6/24/69	12/11/69	
Sweden	8/19/68	1/9/70	
Switzerland	11/27/69	3/9/77 1/	
Syrian Arab Republic	7/1/68	9/24/69 1/	

Country	Date of Signature	Date of Deposit of Ratification	Date of Deposit of Accession (A) or Succession(S)
Thailand			12/2/72(A)
Togo	7/1/68	2/26/70	
Tonga			7/7/71(S)
Trinidad and Tobago	8/20/68		
Tunisia	7/1/68	2/26/70	
Turkey	1/28/69	4/17/80 [1]	
Tuvalu			1/19/79(S)
Uganda			10/20/82(A)
Union of Soviet Socialist Republics	7/1/68	3/5/70	
United Kingdom	7/1/68	11/27/68 [5]	
United States	7/1/68	3/5/70	
Uruguay	7/1/68	8/31/70	
Venezuela	7/1/68	9/25/75	
Vietnam, Socialist Republic of			6/14/82(A)
Western Samoa			3/17/75(A)
Yemen Arab Republic (Sana)	9/23/68		
Yemen, People's Democratic Republic of (Aden)	11/14/68	6/1/79	
Yugoslavia	7/10/68	3/4/70 [1]	
Zaire	7/22/68	8/4/70	
Taiwan [6]	7/1/68	1/27/70 [6]	

Dates given are the earliest dates on which a country signed the Treaty or deposited its instrument of ratification or accession — whether in Washington, London, or Moscow. In the case of a country that was a dependent territory which became a party through succession, the date given is the date on which the country gave notice that it would continue to be bound by the terms of the Treaty.

[1] With Statement.

[2] Applicable to Berlin (West).

[3] Extended to Netherlands Antilles.

[4] Date of general declaration to the Secretary General of the UN concerning continuing treaty obligations applicable prior to independence. The United States considers each of these countries bound by the obligations in the treaty in accordance with its general declaration, but not a party pending deposit of an instrument of succession or accession.

[5] Extended to Anguilla and territories under the territorial sovereignty of the United Kingdom.

[6] On January 27, 1970, an instrument of ratification was deposited in the name of the Republic of China. Effective January 1, 1979, the United States recognized the People's Republic of China as the sole legal government of China. The authorities on Taiwan state that they will continue to abide by the provisions of the Treaty and the United States regards them as bound by its obligations.

Source: U.S. Department of State, Office of the Legal Adviser, May 1985.

STATES THAT HAVE NOT SIGNED THE NPT
(January 1984)

Nuclear-Weapon states

China

France

Non-Nuclear Weapon States

Albania
Algeria
Argentina
Bahrain
Bhutan
Brazil
Burma
Chile
Comoros
Cuba
Democratic People's Republic of Korea
Democratic Republic of Vietnam

Guinea
Guyana
India
Israel
Malawi
Mauritania
Monaco
Mozambique
Niger
Oman
Pakistan
Qatar

Saudia Arabia
Socialist Republic of Vietnam
South Africa
Spain
United Arab Emirates
United Republic of Tanzania
Zambia

STATES THAT HAVE SIGNED THE NPT, BUT NOT YET RATIFIED

Colombia
Kuwait

Trinidad and Tobago

Yemen Arab Republic

NUCLEAR-WEAPONS STATES THAT HAVE RATIFIED THE NPT

The Union of Soviet Socialist Republics
The United Kingdom
The United States

Convention on the Physical Protection of Nuclear Material

Signed at New York March 3, 1980
Ratification advised by U.S. Senate July 30, 1981
Ratified by U.S. President September 4, 1981

The States Parties to This Convention,

Recognizing the right of all States to develop and apply nuclear energy for peaceful purposes and their legitimate interests in the potential benefits to be derived from the peaceful application of nuclear energy,

Convinced of the need for facilitating international co-operation in the peaceful application of nuclear energy,

Desiring to avert the potential dangers posed by the unlawful taking and use of nuclear material,

Convinced that offenses relating to nuclear material are a matter of grave concern and that there is an urgent need to adopt appropriate and effective measures to ensure the prevention, detection and punishment of such offenses,

Aware of the Need for international co-operation to establish, in conformity with the national law of each State Party and with this Convention, effective measures for the physical protection of nuclear material,

Convinced that this Convention should facilitate the safe transfer of nuclear material,

Stressing also the importance of the physical protection of nuclear material in domestic use, storage and transport,

Recognizing the importance of effective physical protection of nuclear material used for military purposes, and understanding that such material is and will continue to be accorded stringent physical protection,

Have Agreed as follows:

Article 1

For the purposes of this Convention:

(a) "nuclear material" means plutonium except that with isotopic concentration exceeding 80% in plutonium-238; uranium-233; uranium enriched in the isotopes 235 or 233; uranium containing the mixture of isotopes as occurring in nature other than in the form of ore or ore-residue; any material containing one or more of the foregoing;

(b) "uranium enriched in the 235 or 233" means uranium containing the isotopes 235 or 233 or both in an amount such that the abundance ratio of the sum of these isotopes to the isotope 238 is greater than the ratio of the isotope 235 to the isotope 238 occurring in nature;

(c) "international nuclear transport" means the carriage of a consignment of nuclear material by any means of transportation intended to go beyond the territory of the State where the shipment originates beginning with the departure from a facility of the shipper in that State and ending with the arrival at a facility of the receiver within the State of ultimate destination.

Article 2

1. The Convention shall apply to nuclear material used for peaceful purposes while in international nuclear transport.

2. With the exception of articles 3 and 4 and paragraph 3 of article 5, this Convention shall also apply to nuclear material used for peaceful purposes while in domestic use, storage and transport.

3. Apart from the commitments expressly undertaken by States Parties in the articles covered by paragraph 2 with respect to nuclear material used for peaceful purposes while in domestic use, storage and transport, nothing in this Convention shall be interpreted as affecting the sovereign rights of a State regarding the domestic use, storage and transport of such nuclear material.

Article 3

Each State Party shall take appropriate steps within the framework of its national law and consistent with international law to ensure as far as practicable that, during international nuclear transport, nuclear material within its territory, or on board a ship or aircraft under its jurisdiction insofar as such ship or aircraft is engaged in the transport to or from that State, is protected at the levels described in Annex I.

Article 4

1. Each State Party shall not export or authorize the export of nuclear material unless the State Party has received assurances that such material will be protected during the international nuclear transport at the levels described in Annex I.

2. Each State Party shall not import or authorize the import of nuclear material from a State not party to this Convention unless the State Party has received assurances that such material will during the international nuclear transport be protected at the levels described in Annex I.

3. A State Party shall not allow the transit of its territory by land or internal waterways or through its airports or seaports of nuclear material between States that are not parties to this Convention unless the State Party has received assurances as far as practicable that this nuclear material will be protected during international nuclear transport at the levels described in Annex I.

4. Each State Party shall apply within the framework of its national law the levels of physical protection described in Annex I to nuclear material being transported from a part of that State to another part of the same State through international waters or airspace.

5. The State Party responsible for receiving assurances that the nuclear material will be protected at the levels described in Annex I according to paragraphs 1 to 3 shall identify and inform in advance States which the nuclear material is expected to transit by land or internal waterways, or whose airports or seaports it is expected to enter.

6. The responsibility for obtaining assurances referred to in paragraph 1 may be transferred, by mutual agreement, to the State Party involved in the transport as the importing State.

7. Nothing in this article shall be interpreted as in any way affecting the territorial sovereignty and jurisdiction of a State, including that over its airspace and territorial sea.

Article 5

1. States Parties shall identify and make known to each other directly or through the International Atomic Energy Agency their central authority and point of contact having responsibility for physical protection of nuclear material and for co-ordinating recovery and response operations in the event of any unauthorized removal, use or alteration of nuclear material or in the event of credible threat thereof.

2. In the case of theft, robbery or any other unlawful taking of nuclear material or of credible threat thereof, States Parties shall, in accordance with their national law, provide co-operation and assistance to the maximum feasible extent in the recovery and protection of such material to any State that so requests. In particular:

(a) a State Party shall take appropriate steps to inform as soon as possible other States, which appear to it to be concerned, of any theft, robbery or other unlawful taking of nuclear material or credible threat thereof and to inform, where appropriate, international organizations;

(b) as appropriate, the States Parties concerned shall exchange information with each other or international organizations with a view to protecting threatened nuclear material, verifying the integrity of the shipping container, or recovering unlawfully taken nuclear material and shall:

(i) co-ordinate their efforts through diplomatic and other agreed channels;

(ii) render assistance, if requested;

(iii) ensure the return of nuclear material stolen or missing as a consequence of the above-mentioned events.

The means of implementation of this co-operation shall be determined by the States Parties concerned.

3. States Parties shall co-operate and consult as appropriate, with each other directly or through international organizations, with a view to obtaining guidance on the design, maintenance and improvement of systems of physical protection of nuclear material in international transport.

Article 6

1. States Parties shall take appropriate measures consistent with their national law to protect the confidentiality of any information which they receive in confidence by virtue of the provisions of this Convention from another State Party or through participation in an activity carried out for the implementation of this Convention. If States Parties provide information to international organizations in confidence, steps shall be taken to ensure that the confidentiality of such information is protected.

2. States Parties shall not be required by this Convention to provide any information which they are not permitted to communicate pursuant to national law or which would jeopardize the security of the State concerned or the physical protection of nuclear material.

Article 7

1. The intentional commission of:

(a) an act without lawful authority which constitutes the receipt, possession, use, transfer, alteration, disposal or dispersal of nuclear material and which causes or is likely to cause death or serious injury to any person or substantial damage to property;

(b) a theft or robbery of nuclear material;

(c) an embezzlement or fraudulent obtaining of nuclear material;

(d) an act constituting a demand for nuclear material by threat or use of force or by any other form of intimidation;

(e) a threat:

(i) to use nuclear material to cause death or serious injury to any person or substantial property damage, or

(ii) to commit an offense described in subparagraph (b) in order to compel a natural or legal person, international organization or State to do or to refrain from doing any act;

(f) an attempt to commit any offense described in paragraphs (a), (b) or (c); and

(g) an act which constitutes participation in any offense described in paragraphs (a) to (f) shall be made a punishable offense by each State Party under its national law.

2. Each State Party shall make the offences described in this article punishable by appropriate penalties which take into account their grave nature.

Article 8

1. Each State Party shall take such measures as may be necessary to establish its jurisdiction over the offenses set forth in article 7 in the following cases:

(a) when the offense is committed in the territory of that State or on board a ship or aircraft registered in that State;

(b) when the alleged offender is a national of that State.

2. Each State Party shall likewise take such measures as may be necessary to establish its jurisdiction over these offenses in cases where the alleged offender is present in its territory and it does not extradite him pursuant to article 11 to any of the States mentioned in paragraph 1.

3. This Convention does not exclude any criminal jurisdiction exercised in accordance with national law.

4. In addition to the State Parties mentioned in paragraphs 1 and 2, each State Party may, consistent with international law, establish its jurisdiction over the offenses set forth in article 7 when it is involved in international nuclear transport as the exporting or importing State.

Article 9

Upon being satisfied that the circumstances so warrant, the State Party in whose territory the alleged offender is present shall take appropriate measures, including detention, under its national law to ensure his presence for the purpose of prosecution or extradition. Measures taken according to this article shall be notified without delay to the States required to establish jurisdiction pursuant to article 8 and, where appropriate, all other States concerned.

Article 10

The State Party in whose territory the alleged offender is present shall, if it does not extradite him, submit, without exception whatsoever and without undue delay, the case to its competent authorities for the purpose of prosecution, through proceedings in accordance with the laws of that State.

Article 11

1. The offenses in article 7 shall be deemed to be included as extraditable offenses in any extradition treaty existing between States Parties. States Parties undertake to include those offenses as extraditable offenses in every future extradition treaty to be concluded between them.

2. If a State Party which makes extradition conditional on the existence of a treaty receives a request for extradition from another State Party with which it has no extradition treaty, it may at its option consider this Convention as the legal basis for extradition in respect of those offenses. Extradition shall be subject to the other conditions provided by the law of the requested State.

3. States Parties which do not make extradition conditional on the existence of a treaty shall recognize those offenses as extraditable offenses between themselves subject to the conditions provided by the law of the requested State.

4. Each of the offenses shall be treated, for the purpose of extradition between States Parties, as if it had been committed not only in the place in which it occurred but also in the territories of the States Parties required to establish their jurisdiction in accordance with paragraph 1 of article 8.

Article 12

Any person regarding whom proceedings are being carried out in connection with any of the offenses set forth in article 7 shall be guaranteed fair treatment at all stages of the proceedings.

Article 13

1. States Parties shall afford one another the greatest measure of assistance in connection with criminal proceedings brought in respect of the offenses set forth in article 7, including the supply of evidence at their disposal necessary for the proceedings. The law of the State requested shall apply in all cases.

2. The provisions of paragraph 1 shall not affect obligations under any other treaty, bilateral or multilateral, which governs or will govern, in whole or in part, mutual assistance in criminal matters.

Article 14

1. Each State Party shall inform the depositary of its laws and regulations which give effect to this Convention. The depositary shall communicate such information periodically to all States Parties.

2. The State Party where an alleged offender is prosecuted shall, wherever practicable, first communicate the final outcome of the proceedings to the States directly concerned. The State Party shall also communicate the final outcome to the depositary who shall inform all States.

3. Where an offense involves nuclear material used for peaceful purposes in domestic use, storage or transport, and both the alleged offender and the nuclear material remain in the territory of the State Party in which the offense was committed, nothing in this Convention shall be interpreted as requiring that State Party to provide information concerning criminal proceedings arising out of such an offense.

Article 15

The Annexes constitute an integral part of this Convention.

Article 16

1. A conference of States Parties shall be convened by the depositary five years after the entry into force of this Convention to review the implementation of the Convention and its adequacy as concerns the preamble, the whole of the operative part and the annexes in the light of the then prevailing situation.

2. At intervals of not less than five years thereafter, the majority of States Parties may obtain, by submitting a proposal to this effect to the depositary, the convening of further conferences with the same objective.

Article 17

1. In the event of a dispute between two or more States Parties concerning the interpretation or application of this Convention, such States Parties shall consult with a view to the settlement of the dispute by negotiation, or by any other peaceful means of settling disputes acceptable to all parties to the dispute.

2. Any dispute of this character which cannot be settled in the manner prescribed in paragraph 1 shall, at the request of any party to such dispute, be submitted to arbitration or referred to the International Court of Justice for decision. Where a dispute is submitted to arbitration, if, within six months from the date of the request, the parties to the dispute are unable to agree on the organization of the arbitration, a party may request the President of the International Court of Justice or the Secretary-General of the United Nations to appoint one or more arbitrators. In case of conflicting requests by the parties to the dispute, the request to the Secretary-General of the United Nations shall have priority.

3. Each State Party may at the time of signature, ratification, acceptance or approval of this Convention or accession thereto declare that it does not consider itself bound by either or both of the dispute settlement procedures provided for in paragraph 2. The other States Parties shall not be bound by a dispute settlement procedure provided for in paragraph 2, with respect to a State Party which has made a reservation to that procedure.

4. Any State Party which has made a reservation in accordance with paragraph 3 may at any time withdraw that reservation by notification to the depositary.

Article 18

1. This Convention shall be open for signature by all States at the Headquarters of the International Atomic Energy Agency in Vienna and at the Headquarters of the United Nations in New York from 3 March 1980 until its entry into force.

2. This Convention is subject to ratification, acceptance or approval by the signatory States.

3. After its entry into force, this Convention will be open for accession by all States.

4. (a) This Convention shall be open for signature or accession by international organizations and regional organizations of an integration or other nature, provided that any such organization is constituted by sovereign States and has competence in respect of the negotiation, conclusion and application of international agreements in matters covered by this Convention.

   (b) In matters within their competence, such organizations shall, on their own behalf, exercise the rights and fulfill the responsibilities which this Convention attributes to States Parties.

(c) When becoming party to this Convention such an organization shall communicate to the depositary a declaration indicating which States are members thereof and which articles of this Convention do not apply to it.

(d) Such an organization shall not hold any vote additional to those of its Member States.

5. Instruments of ratification, acceptance, approval or accession shall be deposited with the depositary.

Article 19

1. This Convention shall enter into force on the thirtieth day following the date of deposit of the twenty first instrument of ratification, acceptance or approval with the depositary.

2. For each State ratifying, accepting, approving or acceding to the Convention after the date of deposit of the twenty first instrument of ratification, acceptance or approval, the Convention shall enter into force on the thirtieth day after the deposit by such State of its instrument of ratification, acceptance, approval or accession.

Article 20

1. Without prejudice to article 16 a State Party may propose amendments to this Convention. The proposed amendment shall be submitted to the depositary who shall circulate it immediately to all States Parties. If a majority of States Parties request the depositary to convene a conference to consider the proposed amendments, the depositary shall invite all States Parties to attend such a conference to begin not sooner than thirty days after the invitations are issued. Any amendment adopted at the conference by a two-thirds majority of all States Parties shall be promptly circulated by the depositary to all States Parties.

2. The amendment shall enter into force for each State Party that deposits its instrument of ratification, acceptance or approval of the amendment on the thirtieth day after the date on which two thirds of the States Parties have deposited their instruments of ratification, acceptance or approval with the depositary. Thereafter, the amendment shall enter into force for any other State Party on the day on which that State Party deposits its instrument of ratification, acceptance or approval of the amendment.

Article 21

1. Any State Party may denounce this Convention by written notification to the depositary.

2. Denunciation shall take effect one hundred and eighty days following the date on which notification is received by the depositary.

Article 22

The depositary shall promptly notify all States of:

(a) each signature of this Convention;

(b) each deposit of an instrument of ratification, acceptance, approval or accession;

(c) any reservation or withdrawal in accordance with article 17;

(d) any communication made by an organization in accordance with paragraph 4(c) of article 18;

(e) the entry into force of this Convention;
(f) the entry into force of any amendment to this Convention; and
(g) any denunciation made under article 21.

Article 23

The original of this Convention, of which the Arabic, Chinese, English, French, Russian and Spanish texts are equally authentic, shall be deposited with the Director General of the International Atomic Energy Agency who shall send certified copies thereof to all States.

Annex I

Levels of Physical Protection To Be Applied in International Transport of Nuclear Material as Categorized in Annex II

1. Levels of physical protection for nuclear material during storage incidental to international nuclear transport include:

(a) For Category III materials, storage within an area to which access is controlled;

(b) For Category II materials, storage within an area under constant surveillance by guards or electronic devices, surrounded by a physical barrier with a limited number of points of entry under appropriate control or any area with an equivalent level of physical protection;

(c) For Category I material, storage within a protected area as defined for Category II above, to which, in addition, access is restricted to persons whose trustworthiness has been determined, and which is under surveillance by guards who are in close communication with appropriate response forces. Specific measures taken in this context should have as their object the detection and prevention of any assault, unauthorized access or unauthorized removal of material.

2. Levels of physical protection for nuclear material during international transport include:

(a) For Category II and III materials, transportation shall take place under special precautions including prior arrangements among sender, receiver, and carrier, and prior agreement between natural or legal persons subject to the jurisdiction and regulation of exporting and importing States, specifying time, place and procedures for transferring transport responsibility;

(b) For Category I materials, transportation shall take place under special precautions identified above for transportation of Category II and III materials, and in addition, under constant surveillance by escorts and under conditions which assure close communication with appropriate response forces;

(c) For natural uranium other than in the form of ore or ore-residue, transportation protection for quantities exceeding 500 kilograms U shall include advance notification of shipment specifying mode of transport, expected time of arrival and confirmation of receipt of shipment.

IN WITNESS WHEREOF, the undersigned, being duly authorized, have signed this Convention, opened for signature at Vienna and at New York on 3 March 1980.

STATES THAT HAVE SIGNED OR RATIFIED THE CONVENTION ON THE PHYSICAL PROTECTION OF NUCLEAR MATERIAL

Country	Signature	Ratification
Australia	February 22, 1984	
Austria	March 3, 1980	
Belgium	June 13, 1980	
Brazil	May 15, 1981 3/	
Bulgaria	June 23, 1981 1/	April 10, 1984 1/
Canada	September 23, 1980	
Czechoslovakia	September 14, 1981 1/	April 23, 1982 1/
Denmark	June 13, 1980	
Dominican Republic	March 3, 1980	
European Atomic Energy Community	June 13, 1980 2/	
Finland	June 25, 1981	
France	June 13, 1980 1/	
German Democratic Republic	May 21, 1980 1/	February 5, 1981 1/
Germany, Federal Republic of	June 13, 1980	
Greece	March 3, 1980	
Guatemala	March 12, 1980	April 23, 1985
Haiti	April 10, 1980	
Hungary	June 17, 1980 1/	May 4, 1984 1/
Ireland	June 13, 1980	
Israel	June 17, 1983 1/	
Italy	June 13, 1980 1/ 2/	
Korea (Republic of)	December 29, 1981 1/	April 7, 1982 1/
Luxembourg	June 13, 1980	
Morocco	July 25, 1980	
Netherlands	June 13, 1980	
Niger	January 7, 1985	
Norway	January 26, 1983	
Panama	March 18, 1980	
Paraguay	May 21, 1980	February 6, 1985
Philippines	May 19, 1980	September 21, 1981
Poland	August 6, 1980 1/	October 5, 1983 1/
Portugal	September 19, 1984	
Romania	January 15, 1981 1/ 2/	
South Africa	May 18, 1981 1/	
Sweden	July 2, 1980	August 1, 1980
Turkey	August 23, 1983 1/	February 27, 1985
United States	March 3, 1980	December 13, 1982
USSR	May 22, 1980 1/	May 25, 1983 1/
United Kingdom	June 13, 1980	
Yugoslavia	July 15, 1980	

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1 With reservation(s).

2 With declaration(s).

3 Ad referendum National Congress.

Wang 0013H

May 1985
Office of the Legal Adviser
Department of State

PART II. U.S. LEGISLATION

Atomic Energy Act of 1954, as amended

Partial Text of Public Law 83-703 [H.R. 9757], 68 Stat. 919, approved August, 30, 1954 [1]

AN ACT To amend the Atomic Energy Act of 1946, as amended, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Atomic Energy Act of 1946, as amended, is amended to read as follows:

"ATOMIC ENERGY ACT OF 1954

NOTE.—The Energy Reorganization Act of 1974 (Public Law 93-438, 88 Stat. 1233, approved October 11, 1974; 42 U.S.C. 5801-5891) repealed Sections 21 and 22 abolishing the Atomic Energy Commission created thereunder and vesting its licensing and related regulatory authority of facilities under chapters 6, 7, 8, and 10 in a new Nuclear Regulatory Commission and transferring all its other functions to a new Energy Research and Development Administration. All functions of the Energy Research and Development Administration were subsequently transferred to the Department of Energy which was established, effective October 1, 1977, pursuant to the Department of Energy Organization Act (91 Stat. 569) and Executive Order 12009 of September 13, 1977.

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[1] 42 U.S.C. 2011-2281. Amended by Public Law 84-337 (69 Stat. 630); Public Law 84-722 (70 Stat. 553); Public Law 84-1006 (70 Stat. 1069); Public Law 85-14 (71 Stat. 11); Public Law 85-79 (71 Stat. 274); Public Law 85-162 (71 Stat. 410); Public Law 85-177 (71 Stat. 455); Public Law 85-256 (71 Stat. 576); Public Law 85-287 (71 Stat. 612); Public Law 85-479 (72 Stat. 276); Public Law 85-507 (72 Stat. 337); Public Law 85-602 (72 Stat. 525); Public Law 85-681 (72 Stat. 632); Public Law 85-744 (72 Stat. 837); Public Law 86-43 (73 Stat. 73); Public Law 86-50 (73 Stat. 87); Public Law 86-300 (73 Stat. 574); Public Law 86-373 (73 Stat. 688); Public Law 87-206 (75 Stat. 476); Public Law 87-615 (76 Stat. 409); Public Law 87-793 (76 Stat. 864); Public Law 88-72 (77 Stat. 88); Public Law 88-294 (78 Stat. 172); Public Law 88-394 (78 Stat. 376); Public Law 88-426 (78 Stat. 423); Public Law 88-448 (78 Stat. 490); Public Law 88-489 (78 Stat. 602); Public Law 89-135 (79 Stat. 551); Public Law 89-210 (79 Stat. 855); Public Law 89-645 (80 Stat. 891); Public Law 90-190 (81 Stat. 577); Public Law 91-161 (83 Stat. 444); Public Law 91-452 (84 Stat. 930); Public Law 91-560 (84 Stat. 1472); Public Law 92-84 (85 Stat. 307); Public Law 92-307 (86 Stat. 191); Public Law 92-314 (86 Stat. 227); Public Law 93-377 (88 Stat. 472); Public Law 93-438 (88 Stat. 1233); Public Law 93-485 (88 Stat. 1460); Public Law 93-514 (88 Stat. 1611); Public Law 94-197 [H.R. 8631], 89 Stat. 1111, approved Dec. 31, 1975; Public Law 95-110 [S. 1153], 91 Stat. 884, approved Sept. 20, 1977; Public Law 95-242 (92 Stat. 120); Public Law 95-601 (92 Stat. 2947 at 2950); Public Law 95-604 (92 Stat. 3021); Public Law 96-106 (93 Stat. 796 at 800); Public Law 96-295 (94 Stat. 780 at 786); Public Law 97-164 (96 Stat. 25 at 48 and 49); Public Law 97-90 (95 Stat. 1171); and by Public Law 97-415 (96 Stat. 2067).

"CHAPTER 1. DECLARATION, FINDINGS, AND PURPOSE

"**Section 1. Declaration.**—Atomic energy is capable of application for peaceful as well as military purposes. It is therefore declared to be the policy of the United States that—

"a. the development, use, and control of atomic energy shall be directed so as to make the maximum contribution to the general welfare, subject at all times to the paramount objective of making the maximum contributions to the common defense and security; and

"b. the development, use, and control of atomic energy shall be directed so as to promote world peace, improve the general welfare, increase the standard of living, and strengthen free competition in private enterprise.

"**Sec. 2. Findings.**[2]—The Congress of the United States hereby makes the following findings concerning the development, use, and control of atomic energy:

"a. The development, utilization, and control of atomic energy for military and for all other purposes are vital to the common defense and security.

"c.[3] The processing and utilization of source, byproduct, and special nuclear material affect interstate and foreign commerce and must be regulated in the national interest.

"d. The processing and utilization of source, byproduct, and special nuclear material must be regulated in the national interest and in order to provide for the common defense and security and to protect the health and safety of the public.

"e. Source and special nuclear material, production facilities, and utilization facilities are affected with the public interest, and regulation by the United States of the production and utilization of atomic energy and of the facilities used in connection therewith is necessary in the national interest to assure the common defense and security and to protect the health and safety of the public.

"f. The necessity for protection against possible interstate damage occurring from the operation of facilities for the production or utilization of source or special nuclear material places the operation of those facilities in interstate commerce for the purposes of this Act.

"g. Funds of the United States may be provided for the development and use of atomic energy under conditions which will provide for the common defense and security and promote the general welfare.

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[2] Sec. 20 of Public Law 88-489 (78 Stat. 602) (1964), the Private Ownership of Special Nuclear Materials Act, reads as follows:

"Nothing in this Act shall be deemed to diminish existing authority of the United States, or of the Atomic Energy Commission under the Atomic Energy Act of 1954, as amended, to regulate source, byproduct, and special nuclear material and production and utilization facilities, or to control such materials and facilities exported from the United States by imposition of governmental guarantees and security safeguards with respect thereto, in order to assure the common defense and security and to protect the health and safety of the public, or to reduce the responsibility of the Atomic Energy Commission to achieve such objectives."

[3] Public Law 88-489 (78 Stat. 602) (1964), sec. 1, deleted subsec. 2b. Subsec. 2b. read as follows:

"b. In permitting the property of the United States to be used by others, such use must be regulated in the national interest and in order to provide for the common defense and security and to protect the health and safety of the public."

"i.[4] In order to protect the public and to encourage the development of the atomic energy industry, in the interest of the general welfare and of the common defense and security, the United States may make funds available for a portion of the damages suffered by the public from nuclear incidents, and may limit the liability of those persons liable for such losses.[5]

"**Sec. 3. Purpose.**—It is the purpose of this Act to effectuate the policies set forth above by providing for—

"a. a program of conducting, assisting, and fostering research and development in order to encourage maximum scientific and industrial progress;

"b. a program for the dissemination of unclassified scientific and technical information and for the control, dissemination, and declassification of Restricted Data, subject to appropriate safeguards, so as to encourage scientific and industrial progress;

"c. a program for Government control of the possession, use, and production of atomic energy and special nuclear material, whether owned by the Government or others, so directed as to make the maximum contributions to the common defense and security and the national welfare, and to provide continued assurance of the Government's ability to enter into and enforce agreements with nations or groups of nations for the control of special nuclear materials and atomic weapons.[6]

"d. a program to encourage widespread participation in the development and utilization of atomic energy for peaceful purposes to the maximum extent consistent with the common defense and security and with the health and safety of the public;

"e. a program of international cooperation to promote the common defense and security and to make peaceful applications of atomic energy as widely as expanding technology and considerations of the common defense and security will permit; and

"f. a program of administration which will be consistent with the foregoing policies and programs, with international arrangements, and with agreements for cooperation, which will enable the Congress to be currently informed so as to take further legislative action as may be appropriate.

"CHAPTER 2. DEFINITIONS

"**Sec. 11. Definitions.**—The intent of Congress in the definitions as given in this section should be construed from the words or phrases used in the definitions. As used in this Act:

"a. The term 'agency of the United States' means the excecutive branch of the United States, or any Government agency, or the legislative branch of the United States, or any agency, committee, commission, office, or other establishment in the legislative branch, or the judicial branch of the United States, or any office, agency, committee, commission, or other establishment in the judicial branch.

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[4] Public Law 88–489 (78 Stat. 602), sec. 2, deleted subsec. 2h. Subsec. 2h. read as follows:
"h. It is essential to the common defense and security that title to all special nuclear material be in the United States while such special material is within the United States."

[5] Public Law 85-256 (71 Stat. 576) (1957), sec. 1, added subsec. i.

[6] Public Law 88–489 (78 Stat. 602) (1964), sec. 3, amended subsec. c. It formerly read:
"c. A program for Government control of the possession, use, and production of atomic energy and special nuclear material so directed as to make the maximum contribution to the common defense and security and the national welfare;"

"b. The term 'agreement for cooperation' means any agreement with another nation or regional defense organization authorized or permitted by sections 54, 57, 64, 82, 91 c., 103, 104, or 144, and made pursuant to section 123.[7]

"c. The term 'atomic energy' means all forms of energy released in the course of nuclear fission or nuclear transformation.

"d. The term 'atomic weapon' means any device utilizing atomic energy, exclusive of the means for transporting or propelling the device (where such means is a separable and divisible part of the device), the principal purpose of which is for use as, or for development of, a weapon, a weapon prototype, or a weapon test device.

"e.[8] The term 'byproduct material' means (1) any radioactive material (except special nuclear material) yielded in or made radioactive by exposure to the radiation incident to the process of producing or utilizing special nuclear material, and (2) the tailings or wastes produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content.

"f. The term 'Commission' means the Atomic Energy Commission.

"g. The term 'common defense and security' means the common defense and security of the United States.

"h. The term 'defense information' means any information in any category determined by any Government agency authorized to classify information, as being information respecting, relating to, or affecting the national defense.

"i. The term 'design' means (1) specifications, plans, drawings, blueprints, and other items of like nature; (2) the information contained therein; or (3) the research and development data pertinent to the information contained therein.

"j.[9] The term 'extraordinary nuclear occurrence' means any event causing a discharge or dispersal of source, special nuclear, or byproduct material from its intended place of confinement in amounts offsite, or causing radiation levels offsite, which the Commission determines to be substantial, and which the Commission determines has resulted or will probably result in substantial damages to persons offsite or property offsite. Any determination by the Commission that such an event has, or has not, occurred shall be final and conclusive, and no other official or any court shall have power or jurisdiction to review any such determination. The Commission shall establish criteria in writing setting forth the basis upon which such determination shall be made. As used in this subsection, 'offsite' means away from 'the location' or 'the contract location' as defined in the applicable Commission indemnity agreement, entered into pursuant to section 170.

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[7] Public Law 87-206 (75 Stat. 475) (1961, sec. 2, amended subsec. b by adding the reference to sec. 91c.

[8] Subsec. e was amended and restated by sec. 201 of Public Law 95-604 (92 Stat. 3033). The former definition of "byproduct material" included only the text found in phrase (1) of the current subsec. e.

[9] Public Law 89-645 (80 Stat. 891) (1966), sec. 1, added subsecs. j and m.

"k."[10] The term 'financial protection' means the ability to respond in damages for public liability and to meet the costs of investigating and defending claims and settling suits for such damages.

"l. The term 'Government agency' means any executive department, commission, independent establishment, corporation, wholly or partly owned by the United States of America which is an instrumentality of the United States, or any board, bureau, division, service, office, officer, authority, administration, or other establishment in the executive branch of the Government.

"m.[9] The term 'indemnitor' means (1) any insurer with respect to his obligations under a policy of insurance furnished as proof of financial protection; (2) any licensee, contractor or other person who is obligated under any other form of financial protection, with respect to such obligations; and (3) the Commission with respect to any obligation undertaken by it in an indemnity agreement entered into pursuant to section 170.

"n. The term 'international arrangement' means any international agreement hereafter approved by the Congress or any treaty during the time such agreement or treaty is in full force and effect, but does not include any agreement for cooperation.

"o. The term 'Joint Committee' means the Joint Committee on Atomic Energy.

"p. The term 'licensed activity' means an activity licensed pursuant to this Act and covered by the provisions of section 170.a.[11]

"q. The term 'nuclear incident' means any occurrence, including an extradordinary nuclear occurrence[12] within the United States causing, within or outside the United States, bodily injury, sickness, disease, or death, or loss of or damage to property, or loss of use of property, arising out of or resulting from the radioactive, toxic, explosive, or other hazardous properties of source, special nuclear, or byproduct material: *Provided, however,* That as the term is used in subsection 170.l, it shall include any such occurrence outside of the United States: *And provided further,* That as the term is used in section 170 d. it shall include any such occurrence outside the United States if such occurrence involves source, special nuclear, or byproduct material by, and used by or under contract with, the United States: *And provided further,* That as the term is used in subsection 170 c., it shall include any such occurrence outside both the United States and any other nation if such occurrence arises out of or results from the radioactive, toxic, explosive, or other hazardous properties of source, special nuclear, or byproduct material licensed pursuant to chapters 6, 7, 8, and 10 of this Act which is used in connection with the operation of a licensed stationary production or utilization facility or which moves outside the territorial limits of the United States in transit from one person licensed by the Commission to another person licensed by the Commission.[13]

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[10] Public Law 85-256 (71 Stat. 576) (1957), sec. 3, added subsec. k.

[11] Public Law 85-256 (71 Stat. 576) (1957), sec. 3, added subsec. p.

[12] Public Law 89-645 (80 Stat. 891) (1966), sec. 1, amended this subsection by inserting the phrase, "including an extraordinary nuclear occurrence."

"r. The term 'operator' means any individual who manipulates the controls of a utilization or production facility.

"s. The term 'person' means (1) any individual, corporation, partnership, firm, association, trust, estate, public or private institution, group, Government agency, other than the Commission, any State or any political subdivision of, or any political entity within a State, any foreign government or nation or any political subdivision of any such government or nation, or other entity; and (2) any legal successor, representative, agent, or agency of the foregoing.

"t. The term 'person indemnified' means (1) with respect to a nuclear incident occurring within the United States or outside the United States as the term is used in subsection 170 c., and with respect to any other nuclear incident in connection with the design, development, construction, operation, repair, maintenance, or use of the nuclear ship *Savannah*, the person with whom an indemnity agreement is executed or who is required to maintain financial protection, and any other person who may be liable for public liability or (2) with respect to any other nuclear incident occurring outside the United States, the person with whom an indemnity agreement is executed and any other person who may be liable for public liability by reason of his activities under any contract with the Commission or any project to which indemnification under the provisions of subsection 170 d. has been extended or under any subcontract, purchase order or other agreement, of any tier, under any such contract or project.[14]

"u. The term 'produce', when used in relation to special nuclear material, means (1) to manufacture, make, produce, or refine special nuclear material; (2) to separate special nuclear material from other substances in which such material may be contained; or (3) to make or to produce new special nuclear material.

"v. The term 'production facility' means (1) any equipment or device determined by rule of the Commission to be capable of the production of special nuclear material in such quantity as to be of significance to the common defense and security, or in such manner as to affect the health and safety of the public; or (2) any important component part especially designed for such equipment or device as determined by the Commission.

"w. The term 'public liability' means any legal liability arising out of or resulting from a nuclear incident, except: (i) claims under State or Federal workmen's compensation acts of employees of persons indemnified who are employed at the site of and in connection with the activity where the nuclear incident occurs; (ii) claims arising out of an act of war; and (iii) whenever used in subsections 170 a., c., and k., claims for loss of, or damage to, or loss of use of property which is located at the site of and used in connection with the licensed activity which the nuclear incident occurs. 'Public liability' also includes damage to property of persons indemnified: *Provided*, That such property is covered under the terms of the financial protection required, except property which is located at the site of and used in connection with the activity where the nuclear incident occurs.[15]

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[13] Public Law 85-256 (71 Stat. 576) (1957), sec. 3, added subsec. q. Prior to amendment by Public Law 89-645 (see footnote 9, page 582) the subsection had been amended by Public Law 87-615 (76 Stat. 409) (1962), sec. 4. Before amendment it read: "c. The term 'nuclear incident' means any occurrence within the United States causing bodily injury, sickness, disease, or death, or loss of or damage to property, or for loss of use of property, arising out of or resulting from the radioactive, toxic, explosive, or other hazardous properties of source, special nuclear, or byproduct material: *Provided, however*, That as the term is used in subsection 170 l., it shall mean any such occurrence outside of the United States rather than within the United States." Public Law 94-197 (89 Stat. 1111) (1975), sec. 1, substituted "source, special nuclear, or byproduct material" for "a facility or device" in the second proviso and added the third proviso.

[14] Public Law 85-256 (71 Stat. 576) (1957), sec. 3, added subsec. t. Public Law 87-615 (76 Stat. 409) (1962). Sec. 5, amended the subsection. Before amendment, it read: "r. The term 'person indemnified' means the person with whom an indemnity agreement is executed and any other person who may be liable for public liability." Public Law 94-197 (89 Stat. 1111) (1975), sec. 1, further amended the subsection.

"x. The term 'research and development' means (1) theoretical analysis, exploration, or experimentation; or (2) the extension of investigative findings and theories of a scientific or technical nature into practical application for experimental and demonstration purposes, including the experimental production and testing of models, devices, equipment, materials, and processes.

"y. The term 'Restricted Data' means all data concerning (1) design, manufacture, or utilization of atomic weapons; (2) the production of special nuclear material; or (3) the use of special nuclear material in the production of energy, but shall not include data declassified or removed from the Restricted Data category pursuant to section 142.

"z. The term 'source material' means (1) uranium, thorium, or any other material which is determined by the Commission pursuant to the provisions of section 61 to be source material; or (2) ores containing one or more of the foregoing materials, in such concentration as the Commission may by regulation determine from time to time.

"aa. The term 'special nuclear material' means (1) plutonium, uranium enriched in the isotope 233 or in the isotope 235, and any other material which the Commission, pursuant to the provisions of section 51, determines to be special nuclear material, but does not include source material; or (2) any material artificially enriched by any of the foregoing, but does not include source material.

"bb. The term 'United States' when used in a geographical sense includes all Territories and possessions of the United States, the Canal Zone and Puerto Rico.[16]

"cc. The term 'utilization facility' means (1) any equipment or device, except an atomic weapon, determined by rule of the Commission to be capable of making use of special nuclear material in such quantity as to be of significance to the common defense and security, or in such manner as to affect the health and safety of the public, or peculiarly adapted for making use of atomic energy in such quantity as to be of significance to the common defense and security, or in such manner as to affect the health and safety of the public; or (2) any important component part especially designed for such equipment or device as determined by the Commission.

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[15] Public Law 85-256 (71 Stat. 576) (1957), sec. 3, added subsec. w. Public Law 87-206 (75 Stat. 475) (1961), sec. 3, amended the subsec. Before amendment, it read:

"u. The term 'public liability' means any legal liability arising out or resulting from a nuclear incident, except claims under State or Federal Workmen's Compensation Acts of employees or persons indemnified who are employed at the site of and in connection with the activity where the nuclear incident occurs, and except for claims arising out of an act of war. 'Public liability' also includes damage to property of persons indemnified: *Provided*, That such property is covered under the terms of the financial protection required, except property which is located at the site of and used in connection with the activity where the nuclear incident occurs."

[16] Public Law 84-1006 (70 Stat. 1069) (1956), sec. 1, amended this definition. Before amendment it read:

"u. The term 'United States', when used in a geographical sense, includes all Territories and possessions of the United States, and the Canal Zone."

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"Chapter 6. Special Nuclear Material

"**Sec. 51. Special Nuclear Material.**—The Commission may determine from time to time that other material is special nuclear material in addition to that specified in the definition as special nuclear material. Before making any such determination, the Commission must find that such material is capable of releasing substantial quantities of atomic energy and must find that the determination that such material is special nuclear material is in the interest of the common defense and security, and the President must have expressly assented in writing to the determination. The Commission's determination, together with the assent of the President, shall be submitted to the Joint Committee and a period of thirty days shall elapse while Congress is in session (in computing such thirty days, there shall be excluded the days on which either House is not in session because of an adjournment for more than three days) before the determination of the Commission may become effective: *Provided, however,* That the Joint Committee, after having received such determination, may be resolution in writing, waive the conditions of or all or any portion of such thirty-day period.

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"**Sec. 54.**[17] **Foreign Distribution of Special Nuclear Material.**—a. The Commission is authorized to cooperate with any nation or group of nations by distributing special nuclear material and to distribute such special nuclear material, pursuant to the terms of an agreement for cooperation to which such nation or group of nations is a party and which is made in accordance with section 123. Unless hereafter otherwise authorized by law the Commission shall be compensated for special nuclear material so distributed at not less than the Commission's published charges applicable to the domestic distribution of such material, except that the Commission to assist and encourage research on peaceful uses or for medical therapy may so distribute without charge during any calendar year only a quantity of such material which at the time of transfer does not exceed in value $10,000 in the case of one nation or $50,000 in the case of any group of nations. The Commission may distribute to the International Atomic Energy Agency, or to any group of nations, only such amounts of special nuclear materials and for such period of time as are authorized by Congress: *Provided, however,* That, (i) notwithstanding this provision, the Commission is hereby authorized, subject to the provisions of section 123, to distribute to the Agency five thousand kilograms of contained uranium-235, five hundred grams of uranium-233, and three kilograms of plutonium, together with the amounts of special nuclear material which will match in amount the sum of all quantities of special nuclear materials made available by all other members of the Agency to June 1, 1960; and (ii) notwithstanding the foregoing provisions of this subsection, the Commission may distribute to the International Atomic Energy Agency, or to any group of nations, such other amounts of special nuclear materials and for such other periods of time as are established in writing by the Commission: *Provided, however,* That before they are established by the Commission pursuant to this subdivision (ii), such proposed amounts and periods shall be submitted to the Congress and referred to the Joint Committee and a period of sixty days shall elapse while Congress is in session (in computing such sixty days, there shall be excluded the days on which either House is not in session because of an adjournment of more than three days): *And provided further,* That any such proposed amounts and periods shall not become effective if during such sixty-day period the Congress passes a concurrent resolution stating in substance that it does not favor the proposed action: *And provided further,* That prior to the elapse of the first thirty days of any such sixty-day period the Joint Committee shall submit a report to the Congress of its views and recommendations respecting the proposed amounts and periods and an accompanying proposed concurrent resolution stating in substance that the Congress favors, or does not favor, as the case may be, the proposed amounts or periods. The Commission may agree to repurchase any special nuclear material distributed under a sale arrangement pursuant to this subsection which is not consumed in the course of the activities conducted in accordance with the agreement for cooperation, or any uranium remaining after irradiation of such special nuclear material, at a repurchase price not to exceed the Commission's sale price for comparable special nuclear material or uranium in effect at the time of delivery of such material to the Commission. The Commission may also agree to purchase, consistent with and within the period of the agreement for cooperation, special nuclear material produced in a nuclear reactor located outside the United States through the use of special nuclear material which was leased or sold pursuant to this subsection. Under any such agreement the Commission shall purchase only such material as is delivered to the Commission during any period when there is in effect a guaranteed purchase price for the same material produced in a nuclear reactor by a person licensed under section 104, established by the Commission pursuant to section 56, and the price to be paid shall be the price so established by the Commission and in effect for the same material delivered to the Commission.

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[17] Sec. 54 was amended and restated by sec. 2 of Public Law 93-377 (88 Stat. 472).

"b. Notwithstanding the provisions of sections 123, 124, and 125, the Commission is authorized to distribute to any person outside the United States (1) plutonium containing 80 per centum or more by weight of plutonium-238, and (2) other special nuclear material when it has, in accordance with subsection 57 d., exempted certain classes or quantities of such other special nuclear material or kinds of uses or users thereof from the requirements for a license set forth in this chapter. Unless hereafter otherwise authorized by law, the Commission shall be compensated for special nuclear material so distributed at not less than the Commission's published charges applicable to the domestic distribution of such material. The Commission shall not distribute any plutonium containing 80 per centum or more by weight of plutonium-238 to any person under this subsection if, in its opinion, such distribution would be inimical to the common defense and security. The Commission may require such reports regarding the use of material distributed pursuant to the provisions of this subsection as it deems necessary.

"c. The Commission is authorized to license or otherwise permit others to distribute special nuclear material to any person outside the United States under the same conditions, except as to charges, as would be applicable if the material were distributed by the Commission.

"d.[18] The authority to distribute special nuclear material under this section other than under an export license granted by the Nuclear Regulatory Commission shall extend only to the following small quantities of special nuclear material (in no event more than five hundred grams per year of the uranium isotope 233, the uranium isotope 235, or plutonium contained in special nuclear material to any recipient):

"(1) which are contained in laboratory samples, medical devices, or monitoring or other instruments; or

"(2) the distribution of which is needed to deal with an emergency situation in which time is of the essence.

"e.[19] The authority in this section to commit United States funds for any activities pursuant to any subsequent arrangement under section 131 a. (2)(E) shall be subject to the requirements of section 131.

"**Sec. 55.**[20] **Acquisition.**—The Commission is authorized, to the extent it deems necessary to effectuate the provisions of this Act, to purchase without regard to the limitations in section 54 or any guaranteed purchase prices established pursuant to section 56, and to take, requisition, condemn, or otherwise acquire any special nuclear material or any interest therein. Any contract of purchase made under this section may be made without regard to the provisions of section 3709 of the Revised Statutes, as amended, upon certification by the Commission that such action is necessary in the interest of the common defense and security, or upon a showing by the Commission that advertising is not reasonably practicable. Partial and advance payments may be made under contracts for such purposes. Just compensation shall be made for any right, property, or interest in property taken, requisitioned, or condemned under this section: *Provided*, That the authority in this section to commit United States funds for any activities pursuant to any subsequent arrangements under section 131 a. (2)(E) shall be subject to the requirements of section 131.[21]

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[18] Subsec. d. was added by sec. 301(a) of the Nuclear Non-Proliferation Act of 1978 (92 Stat. 125).

[19] Subsec. e. was added by sec. 303(b)(1) of the Nuclear Non-Proliferation Act of 1978 (92 Stat. 131).

[20] Public Law 88-489 (78 Stat. 602) (1964), sec. 10, amended sec. 55 by substituting a new sec. 55. Before amendment sec. 55 read as follows:

"Sec. 55. Acquisition.—The Commission is authorized to purchase or otherwise acquire any special nuclear material or any interest therein outside the United States without regard to the provisions of section 3709 of the Revised Statutes, as amended, upon certification by the Commission that such action is necessary in the interest of the common defense and security, or upon a showing by the Commission that advertising is not reasonably practicable. Partial and advance payments may be made under contracts for such purposes."

"**Sec. 56. Guaranteed Purchase Prices.**—The Commission shall establish guaranteed purchase prices for plutonium produced in a nuclear reactor by a person licensed under section 104 and delivered to the Commission before January 1, 1971. The Commission shall also establish for such periods of time as it may deem necessary but not to exceed ten years as to any such period, guaranteed purchase prices for uranium enriched in the isotope 233 produced in a nuclear reactor by a person licensed under section 103 or section 104 and delivered to the Commission within the period of the guarantee.[22] Guaranteed purchase prices established under the authority of this section shall not exceed the Commission's determination of the estimated value of plutonium or uranium enriched in the isotope 233 as fuel in nuclear reactors, and such prices shall be established on a nondiscriminatory basis: *Provided*, That the Commission is authorized to establish such guaranteed purchase prices only for such plutonium or uranium enriched in the isotope 233 as the Commission shall determine is produced through the use of special nuclear material which was leased or sold by the Commission pursuant to section 53.[23]

"**Sec. 57.[24] Prohibition.**—

"a. Unless authorized by a general or specific license issued by the Commission, which the Commission is authorized to issue pursuant to section 53, no person may transfer or receive in interstate commerce, transfer, deliver, acquire, own, possess, receive possession of or title to, or import into or export from the United States any special nuclear material.

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[21] The proviso clause was added by sec. 303(b)(2) of the Nuclear Non-Proliferation Act of 1978 (92 Stat. 131).

[22] Public Law 91-500 (84 Stat. 1472) (1970), sec. 2, added "section 103 or" to this sentence.

[23] Public Law 88-489 (78 Stat. 602) (1964), sec. 11 amended sec. 56 by substituting a new sec. 56. Before amendment sec. 56 read as follows:

"Sec. 56. FAIR PRICE.—In determining the fair price to be paid by the Commission pursuant to section 52 for the production of any special nuclear material, the Commission shall take into consideration the value of the special nuclear material for its intended use by the United States and may give such weight to the actual cost of producing that material as the Commission finds to be equitable. The fair price, as may be determined by the Commission, shall apply to all licensed producers of the same material: *Provided, however*, That the Commission may establish guaranteed fair prices for all special nuclear material delivered to the Commission for such period of time as it may deem necessary not to exceed seven years."

[24] Public Law 88-489 (78 Stat. 602) (1964), sec. 12 amended sec. 57 substituting a new sec. 57. "Sec. 57. PROHIBITION.—

Before amendment sec. 57 read as follows:

"a. It shall be unlawful for any person to—

"(1) possess or transfer any special nuclear material which is the property of the United States except as authorized by the Commission pursuant to subsec. 53 a.;

"(2) transfer or receive any special nuclear material in interstate commerce except as authorized by the Commission pursuant to subsection 25 a., or export from or import into the United States any special nuclear material; and

"(3) directly or indirectly engage in the production of any special nuclear material outside of the United States except (A) under an agreement for cooperation made pursuant to section 123, or (B) upon authorization by the Commission after a determination that such activity will not be inimical to the interest of the United States.

"b. The Commission shall not distribute any special nuclear material—

"(1) to any person for a use which is not under the jurisdiction of the United States except pursuant to the provisions of section 54; or

"(2) to any person within the United States, if the Commission finds that the distribution of such special nuclear material to such person would be inimical to the common defense and security."

"b.[25] It shall be unlawful for any person to directly or indirectly engage in the production of any special nuclear material outside of the United States except (1) as specifically authorized under an agreement for cooperation made pursuant to section 123, including a specific authorization in a subsequent arrangement under section 131 of this Act, or (2) upon authorization by the Secretary of Energy after a determination that such activity will not be inimical to the interest of the United States: *Provided,* That any such determination by the Secretary of Energy shall be made only with the concurrence of the Department of State and after consultation with the Arms Control and Disarmament Agency, the Nuclear Regulatory Commission, the Department of Commerce, and the Department of Defense. The Secretary of Energy shall, within ninety days after the enactment of the Nuclear Non-Proliferation Act of 1978, establish orderly and expeditious procedures, including provision for necessary administrative actions and inter-agency memoranda of understanding, which as mutually agreeable to the Secretaries of State, Defense, and Commerce, the Director of the Arms Control and Disarmament Agency, and the Nuclear Regulatory Commission for the consideration of requests for authorization under this subsection.[26] Such procedures shall include, at a minimum explicit direction on the handling of such requests, express deadlines for the solicitation and collection of the views of the consulted agencies (with identified officials responsible for meeting such deadlines), an interagency coordinating authority to monitor the processing of such requests, predetermined procedures for the expeditious handling of intra-agency and inter-agency disagreements and appeals to higher authorities, frequent meetings of inter-agency administrative coordinators to review the status of all pending requests, and similar administrative mechanisms. To the extent practicable, an applicant should be advised of all the information required of the applicant for the entire process for every agency's needs at the beginning of the process. Potentially controversial requests should be identified as quickly as possible so that any required policy decisions or diplomatic consultations can be initiated in a timely manner. An immediate effort should be undertaken to establish quickly any necessary standards and criteria, including the nature of any required assurances or evidentiary showings, for the decision required under this subsection. The processing of any request proposed and filed as of the date of enactment of the Nuclear Non-Proliferation Act of 1978 shall not be delayed pending the development and establishment of procedures to implement the requirements of this subsection. Any trade secrets or proprietary information submitted by any person seeking an authorization under this subsection shall be afforded the maximum degree of protection allowable by law: *Provided further,* That the export of component parts as defined in subsection 11 v. (2) or 11 cc. (2) shall be governed by sections 109 and 126 of this Act: *Provided further*, That notwithstanding subsection 402(d) of the Department of Energy Organization Act (Public Law 95-91), the Secretary of Energy and not the Federal Energy Regulatory Commission, shall have sole jurisdiction within the Department of Energy over any matter arising from any function of the Secretary of Energy in this section, section 54 d., section 64, or section 111 b.

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[25] Subsec. b. was amended and restated by sec. 302 of the Nuclear Non-Proliferation Act of 1978 (92 Stat. 126). It formerly read as follows:

"b. It shall be unlawful for any person to directly or indirectly engage in the production of any special nuclear material outside of the United States except (1) under an agreement for cooperation made pursuant to sec. 123, or (2) upon authorization by the Commission after a determination that such activity will not be inimical to the interest of the United States."

[26] These procedures were issued on June 1, 1978. For text, see vol. III, page 645.

"c. The Commission shall not—

"(1) distribute any special nuclear material to any person for a use which is not under the jurisdiction of the United States except pursuant to the provisions of section 54; or

"(2) distribute any special nuclear material or issue a license pursuant to section 53 to any person within the United States if the Commission finds that the distribution of such special nuclear material or the issuance of such license would be inimical to the common defense and security or would constitute an unreasonable risk to the health and safety of the public.

"d.[27] The Commission is authorized to establish classes of special nuclear material and to exempt certain classes or quantities of special nuclear material or kinds of uses or users from the requirements for a license set forth in this section when it makes a finding that the exemption of such classes or quantities of special nuclear material or such kinds of uses or users would not be inimical to the common defense and security and would not constitute an unreasonable risk to the health and safety of the public.

"e.[28] Special nuclear material, as defined in section 11, produced in facilities licensed under section 103 or 104 may not be transferred, reprocessed, used, or otherwise made available by any instrumentality of the United States or any other person for nuclear explosive purposes."

"Sec. 58.[29] Review.—Before the Commission establishes any guaranteed purchase price or guaranteed purchase price period in accordance with the provisions of section 56, or establishes any criteria for the waiver of any charge for the use of special nuclear material licensed and distributed under section 53, the proposed guaranteed purchase price, guaranteed purchase price period, or criteria for the waiver of such charge shall be submitted to the Joint Committee and a period of forty-five days shall elapse while Congress is in session (in computing such forty-five days there shall be excluded the days in which either House is not in session because of adjournment for more than three days): *Provided, however*, That the Joint Committee, after having received the proposed guaranteed purchase price, guaranteed purchase price period, or criteria for the waiver of such charge, may by resolution in writing waive the conditions of, or all or any portion of, such forty-five day period.

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[27] Subsec. d. was added by sec. 3 of Public Law 93-377 (88 Stat. 472 at 475).

[28] Sec. 14 of Public Law 97-415 (96 Stat. 2075) added subsec. (e).

[29] Public Law 88-489 (78 Stat. 602) (1964), sec. 13, amended sec. 58 by substituting a new sec. 58. Before amendment sec. 58 read as follows:

"Sec. 58. Review.—Before the Commission establishes any *fair price* or guaranteed *fair price* period in accordance with the provisions of section 56, or establishes any criteria for the waiver of any charge for the use of special nuclear material licensed or distributed under section 53 the proposed fair price, guaranteed fair price period, or criteria for the waiver of such charge shall be submitted to the Joint Committee, and a period of forty-five days shall elapse while Congress is in session (in computing such forty-five days there shall be excluded the days in which either House is not in session because of adjournment for more than three days): *Provided, however*, That the Joint Committee, after having received the proposed fair price, guaranteed fair price period, or criteria for the waiver of such charge, may by resolution waive the conditions of or all or any portion of such forty-five day period."

"CHAPTER 7. SOURCE MATERIAL

"**Sec. 61. Source Material.**—The Commission may determine from time to time that other material is source material in addition to those specified in the definition of source material. Before making such determination, the Commission must find that such material is essential to the production of special nuclear material and must find that the determination that such material is source material is in the interest of the common defense and security, and the President must have expressly assented in writing to the determination. The Commission's determination, together with the assent of the President, shall be submitted to the Joint Committee and a period of thirty days shall elapse while Congress is in session (in computing such thirty days, there shall be excluded the days on which either House is not in session because of an adjournment of more than three days) before the determination of the Commission may become effective: *Provided, however,* That the Joint Committee, after having received such determination, may by resolution in writing waive the conditions of or all or any portion of such thirty-day period.

"**Sec. 62. License for Transfers Required.**—Unless authorized by a general or specific license issued by the Commission, which the Commission is hereby authorized to issue, no person may transfer or receive in interstate commerce, transfer, deliver, receive possession of or title to, or import into or export from the United States any source material after removal from its place of deposit in nature, except that licenses shall not be required for quantities of source material which, in the opinion of the Commission, are unimportant.

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"**Sec. 64. Foreign Distribution of Source Material.**—The Commission is authorized to cooperate with any nation by distribution source material and to distribute source material pursuant to the terms of an agreement for cooperation to which such nation is a party and which is made in accordance with section 123. The Commission is also authorized to distribute source material outside of the United States upon a determination by the Commission that such activity will not be inimical to the interests of the United States. The authority to distribute source material under this section other than under an export license granted by the Nuclear Regulatory Commission shall in no case extend to quantities of source material in excess of three metric tons per year per recipient.[30]

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[30] This sentence was added by sec. 301(b) of the Nuclear Non-Proliferation Act of 1978 (92 Stat. 125).

"**Sec. 69. Prohibition.**—The Commission shall not license any person to transfer or deliver, receive possession of or title to, or import into or export from the United States any source material if, in the opinion of the Commission, the issuance of a license to such person for such purpose would be inimical to the common defense and security or the health and safety of the public.

"CHAPTER 8. BYPRODUCT MATERIAL

"**Sec. 81. Domestic Distribution.**—No person may transfer or receive in interstate commerce, manufacture, produce, transfer, acquire, own, possess, import, or export any byproduct material, except to the extent authorized by this section, section 82 or section 84.[31] The Commission is authorized to issue general or specific licenses to applicants seeking to use byproduct material for research or development purposes, for medical therapy, industrial uses, agricultural uses, or such other useful applications as may be developed. The Commission may distribute, sell, loan, or lease such byproduct material as it owns to licensees [32] with or without charge: *Provided, however,* That, for byproduct material to be distributed by the Commission for a charge, the Commission shall establish prices on such equitable basis as, in the opinion of the Commission, (a) will provide reasonable compensation to the Government for such material, (b) will not discourage the use of such material or the development of sources of supply of such material independent of the Commission, and (c) will encourage research and development. In distributing such material, the Commission shall give preference to applicants proposing to use such material either in the conduct of research and development or in medical therapy. Licensees of the Commission may distribute byproduct material only to applicants therefor who are licensed by the Commission to receive such byproduct material. The Commission shall not permit the distribution of any byproduct material to any licensee, and shall recall or order the recall of any distributed material from any licensee, who is not equipped to observe or who fails to observe such safety standards to protect health as may be established by the Commission or who uses such material in violation of law or regulation of the Commission or in a manner other than as disclosed in the application therefor or approved by the Commission. The Commission is authorized to establish classes of byproduct material and to exempt certain classes or quantities of material or kinds of uses or users from the requirments for a license set forth in this section when it makes a finding that the exemption of such classes or quantities of such material or such kinds of uses or users will not constitute an unreasonable risk to the common defense and security and to the health and safety of the public.

"**Sec. 82. Foreign Distribution of Byproduct Material.**—

"a. The Commission is authorized to cooperate with any nation by distributing byproduct material, and to distribute byproduct material, pursuant to the terms of an agreement for cooperation to which such nation is party an which is made in accordance with section 123.

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[31] The reference to sec. 84 was added by sec. 205(b) of Public Law 95-604 (92 Stat. 3039).

[32] Sec. 4 of Public Law 93-377 (88 Stat. 472 at 475) deleted the word "licensees" and substituted "qualified applicants".

"b. The Commission is also authorized to distribute byproduct material to any person outside the United States upon application therefor by such person and demand such charge for such materials as would be charged for the material if it were distributed within the United States: *Provided, however,* That the Commission shall not distribute any such material to any person under this section if, in its opinion, such distribution would be inimical to the common defense and security: *And provided further,* That the Commission may require such reports regarding the use of material distributed pursuant to the provisions of this section as it deems necessary.

"c. The Commission is authorized to license others to distribute byproduct material to any person outside the United States under the same conditions, except as to charges, as would be applicable if the material were distributed by the Commission.

"Sec. 83.[33] Ownership and Custody of Certain Byproduct Material and Disposal Sites.—

"a. Any license issued or renewed after the effective date of this section under section 62 or section 81 for any activity which results in the production of any byproduct material, as defined in section 11 e. (2), shall contain such terms and conditions as the Commission determines to be necessary to assure that, prior to termination of such license—

"(1) the licensee will comply with decontamination, decommissioning, and reclamation standards prescribed by the Commission for sites (A) at which ores were processed primarily for their source material content and (B) at which such byproduct material is deposited, and

"(2) ownership of any byproduct material, as defined in section 11 e. (2), which resulted from such licensed activity shall be transferred to (A) the United States or (B) in the State in which such activity occurred if such State exercises the option under subsection b. (1) to acquire land used for the disposal of byproduct material.

Any license which is in effect on the effective date of this section and which is subsequently terminated without renewal shall comply with paragraphs (1) and (2) upon termination.

"b. (1)(A) The Commission shall require by rule, regulation, or order that prior to the termination of any license which is issued after the effective date of this section, title to the land, including any interests therein (other than land owned by the United States or by a State) which is used for the disposal of any byproduct material, as defined by section 11 e. (2), pursuant to such license shall be transferred to—

"(i) the United States, or

"(ii) the State in which such land is located, at the option of such State, unless the Commission determines prior to such termination that transfer of title to such land and such byproduct material is not necessary or desirable to protect the public health, safety, or welfare or to minimize or eliminate danger to life or property. Such determination shall be made in accordance with section 181 of this Act. Notwithstanding any other provision of law or any such determination, such property and materials shall be maintained pursuant to a license issued by the Commission pursuant to section 81 of this Act in such manner as will protect the public health, safety, and the environment.

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[33] Sec. 83 was added by sec. 202(a) of Public Law 95-604 (92 Stat. 3033). However, sec. 202(b) of that act stated that sec. 83 would not be effective until Nov. 8, 1981. The last sentence of subsec. a. was amended and restated by sec. 20(c) of Public Law 96-106.

"(B) If the Commission determines by order that use of the surface or subsurface estates, or both, of the land transferred to the United States or to a State under subparagraph (A) would not endanger the public health, safety, welfare, or environment, the Commission, pursuant to such regulations as it may prescribe, shall permit the use of the surface or subsurface estates, or both, of such land in a manner consistent with the provisions of this section. If the Commission permits such use of such land, it shall provide the person who transferred such land with the right of first refusal with respect to such use of such land.

"(2) If transfer to the United States of title to such byproduct material and such land is required under this section, the Secretary of Energy or any Federal agency designated by the President shall, following the Commission's determination of compliance under subsection c., assume title and custody of such byproduct material and land transferred as provided in this subsection. Such Secretary or Federal agency shall maintain such material and land in such manner as will protect the public health and safety and the environment. Such custody may be transferred to another officer or instrumentality of the United States only upon approval of the President.

"(3) If transfer to a State of title to such byproduct material is required in accordance with this subsection, such State shall, following the Commission's determination of compliance under subsection d., assume title and custody of such byproduct material and land transferred as provided in this subsection. Such State shall maintain such material and land in such manner as will protect the public health, safety, and the environment.

"(4) In the case of any such license under section 62, which was in effect on the effective date of this section, the Commission may require, before the termination of such license, such transfer of land and interest therein (described in paragraph (1) of this subsection) to the United States or a State in which such land is located, at the option of such State, as may be necessary to protect the public health, welfare, and the environment from any effects associated with such byproduct material. In exercising the authority of this paragraph, the Commission shall take into consideration the status of the ownership of such land and interests therein and the ability of the licensee to transfer title and custody thereof to the United States or a State.

"(5) The Commission may, pursuant to a license, or by rule or order require the Secretary or other Federal agency or State having custody of such property and materials to undertake such monitoring, maintenance, and emergency measures as are necessary to protect the public health and safety and such other actions as the Commission deems necessary to comply with the standards promulgated pursuant to section 84 of this Act. The Secretary or such other Federal agency is authorized to carry out maintenance, monitoring, and emergency measures, but shall take no other action pursuant to such license, rule or order, with respect to such property and materials unless expressly authorized by Congress after the date of enactment of this Act.

"(6) The transfer of title to land or byproduct materials, as defined in section 11 e. (2), to a State or the United States pursuant to this subsection shall not relieve any licensee of liability for any fraudulent or negligent acts done prior to such transfer.

"(7) Material and land transferred to the United States or a State in accordance with this subsection shall be transferred without cost to the United States or a State (other than administrative and legal costs incurred in carrying out such transfer). Subject to the provisions of paragraph (1)(B) of this subsection, the United States or a State shall not transfer title to material or property acquired under this subsection to any person, unless such transfer is in the same manner as provided under section 104(h) of the Uranium Mill Tailings Radiation Control Act of 1978.

"(8) The provisions of this subsection respecting transfer of title and custody to land shall not apply in the case of lands held in trust by the United States for any Indian tribe or lands owned by such Indian tribe subject to a restriction against alienation imposed by the United States. In the case of such lands which are used for the disposal of byproduct material, as defined in section 11 e. (2), the licensee shall be required to enter into such arrangements with the Commission as may be appropriate to assure the long-term maintenance and monitoring of such lands by the United States.

"c. Upon termination of any license to which the section applies, the Commission shall determine whether or not the licensee has complied with all applicable standards and requirements under such license.

"Sec. 84.[34] Authorities of Commission Respecting Certain Byproduct Material.—

"a. The Commission shall insure that the management of any byproduct material, as defined in section 11 e. (2), is carried out in such manner as—

"(1) the Commission deems appropriate to protect the public health and safety and the environment from radiological and nonradiological hazards associated with the processing and with the possession and transfer of such material, taking into account the risk to the public health, safety, and the environment, with due consideration of the economic costs and such other factors as the Commission determines to be appropriate,[35]

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[34] Sec. 84 was added by sec. 206(a) of Public Law 95-604 (92 Stat. 3039).

[35] The words to this point beginning with "taking into account the risk to the public health, * * *" were added by sec. 22(a) of Public Law 97-415 (96 Stat. 2080).

"(2) conforms with applicable general standards promulgated by the Administrator of the Environmental Protection Agency under section 275, and

"(3) conforms to general requirements established by the Commission, with the concurrence of the Administrator, which are, to the maximum extent practicable, at least comparable to requirements applicable to the possession, transfer, and disposal of similar hazardous material regulated by the Administration under Solid Waste Disposal Act, as amended.

"b. In carrying out its authority under this section, the Commission is authorized to—

"(1) by rule, regulation, or order require persons, officers, or instrumentalities exempted from licensing under section 81 of this Act to conduct monitoring, perform remedial work, and to comply with such other measures as it may deem necessary or desirable to protect health or to minimize danger to life or property, and in connection with the disposal or storage of such byproduct material; and

"(2) make such studies and inspections and to conduct such monitoring as may be necessary.

Any violation by any person other than the United States or any officer or employee of the United States or a State of any rule, regulation, or order or licensing provision, of the Commission established under this section or section 83 shall be subject to a civil penalty in the same manner and in the same amount as violations subject to a civil penalty under section 234. Nothing in this section affects any authority of the Commission under any other provision of this Act.

"c.[36] In the case of sites at which ores are processed primarily for their source material content or which are used for the disposal of byproduct material as defined in section 11e. (2), a licensee may propose alternatives to specific requirements adopted and enforced by the Commission under this Act. Such alternative proposals may take into account local or regional conditions, including geology, topography, hydrology and meteorology. The Commission may treat such alternatives as satisfying Commission requirements if the Commission determines that such alternatives will achieve a level of stabilization and containment of the sites concerned, and a level of protection for public health, safety, and the environment from radiological and nonradiological hazards associated with such sites, which is equivalent to, to the extent practicable, or more stringent than the level which would be achieved by standards and requirements adopted and enforced by the Commission for the same purpose and any final standards promulgated by the Administrator of the Environmental Protection Agency in accordance with section 275."

"CHAPTER 9. MILITARY APPLICATION OF ATOMIC ENERGY

"Sec. 91. Authority.—

"a. The Commission is authorized to—

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[36] Sec. 20 of Public Law 97-415 (96 Stat. 2079) added subsec. c.

"(1) conduct experiments and do research and development work in the military application of atomic energy; and

"(2) engage in the production of atomic weapons, or atomic weapon parts, except that such activities shall be carried on only to the extent that the express consent and direction of the President of the United States has been obtained, which consent and direction shall be obtained at least once each year.

"b. The President from time to time may direct the Commission (1) to deliver such quantities of special nuclear material or atomic weapons to the Department of Defense for such use as he deems necessary in the interest of national defense, or (2) to authorize the Department of Defense to manufacture, produce, or acquire any atomic weapon or utilization facility for military purposes: *Provided, however,* That such authorization shall not extend to the production of special nuclear material other than that incidental to the operation of such utilization facilities.

"c.[37] The President may authorize the Commission or the Department of Defense, with the assistance of the other, to cooperate with another nation and, notwithstanding the provisions of section 57, 62, or 81, to transfer by sale, lease, or loan to that nation, in accordance with terms and conditions of a program approved by the President.

"(1) nonnuclear parts of atomic weapons provided that such nation has made substantial progress in the development of atomic weapons, and other nonnuclear parts of atomic weapons systems involving Restricted Data provided that such transfer will not contribute significantly to that nation's atomic weapon design, development, or fabrication capability; for the purpose of improving that nation's state of training and operational readiness;

"(2) utilization facilities for military applications; and

"(3) source, byproduct, or special nuclear material for research on, development of, production of, or use in utilization facilities for military applications; and

"(4) source, byproduct, or special nuclear material for research on, development of, or use in atomic weapons: *Provided, however,* That the transfer of such material to that nation is necessary to improve its atomic weapon design, development, or fabrication capability: *And provided further,* That such nation has made substantial progress in the development of atomic weapons,

whenever the President determines that the proposed cooperation and each proposed transfer arrangement for the nonnuclear parts of atomic weapons and atomic weapons systems, utilization facilities or source, byproduct, or special nuclear material will promote and will not constitute an unreasonable risk to the common defense and security, while such other nation is participating with the United States pursuant to an international arrangement by substantial and material contributions to the mutual defense and security: *Provided, however,* That the cooperation is undertaken pursuant to an agreement entered into in accordance with section

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[37] Public Law 85-479 (72 Stat. 276) (1958), sec. 1, added subsec. c.

123: *And provided further,* That if an agreement for cooperation arranged pursuant to this subsection provides for transfer of utilization facilities for military applications the Commission, or the Department of Defense with respect to cooperation it has been authorized to undertake, may authorize any person to transfer such utilization facilities for military applications in accordance with the terms and conditions of this subsection and of the agreement for cooperation.

"**Sec. 92.**[38] **Prohibition.**—It shall be unlawful, except as provided in section 91, for any person to transfer or receive in interstate or foreign commerce, manufacture, produce, tranfer, acquire, possess, import, or export any atomic weapon. Nothing in this section shall be deemed to modify the provisions of subsection 31 a. or section 101.

"CHAPTER 10. ATOMIC ENERGY LICENSES

"**Sec. 101. License Required.**—It shall be unlawful, except as provided in section 91, for any person within the United States to transfer or receive in interstate commere, manufacture, produce, transfer, acquire, possess, use,[39] import, or export any utilization or production facility except under and in accordance with a license issued by the Commission pursuant to section 103 or 104.

"**Sec. 102.**[40] **Utilization and Production Facilities for Industrial or Commercial Purposes.**—

"a. Except as provided in subsections b. and c., or otherwise specifically authorized by law, any license hereafter issued for a utilization or production facility for industrial or commercial purposes shall be issued pursuant to section 103.

"b. Any license hereafter issued for a utilization or production facility for industrial or commercial purposes, the construction or operation of which was licensed pursuant to subsection 104 b. prior to enactment into law of this subsection, shall be issued under subsection 104 b.

"c. Any license for a utilization or production facility for industrial or commercial purposes constructed or operated under an arrangement with the Commission entered into under the Cooperative Power Reactor Demonstration Program shall, except as otherwise specifically required by applicable law, be issued under subsection 104 b.

"**Sec. 103. Commercial Licenses.**—

"a. The Commission is authorized to issue licenses to persons applying therefor to transfer or receive in interstate commerce, manufacture, produce, transfer, acquire, possess, use,[41] import, or export under the terms of an agreement for cooperation arranged pursuant to section 123, utilization or production facilities for industrial or commercial purposes.[42] Such licenses shall be issued in accordance with the provisions of chapter 16 and subject to such conditions as the Commission may by rule or regulation establish to effectuate the purposes and provisions of this Act.

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[38] Public Law 85-479 (72 Stat. 276), sec. 2, amended sec. 92 by substituting a new sec. 92. Before amendment sec. 92 read as follows:

"SEC. 92. PROHIBITION.—It shall be unlawful for any person to transfer or receive in interstate commerce, manufacture, produce, transfer, acquire, possess, import, or export any atomic weapon, except as may be authorized by the Commission pursuant to the provisions of section 91. Nothing in this section shall be deemed to modify the provisions of subsection 31 a. or section 101."

[39] Public Law 84-1006 (70 Stat. 1069) (1956), sec. 11, added the word "use".

[40] Public Law 91-560 (84 Stat. 1472) (1970), sec. 3, ammended sec. 102. Prior to amendment it read as follows:

"SEC. 102. FINDING OF PRACTICAL VALUE.—Whenever the Commission has made a finding in writing that any type of utilization or production facility has been sufficiently developed to be of practical value for industrial or commercial purposes, the Commission may thereafter issue licenses for such type of facility pursuant to section 103."

"b. The Commission shall issue such licenses on a nonexclusive basis to persons applying therefor (1) whose proposed activities will serve a useful purpose proportionate to the quantities of special nuclear material or source material to be utilized; (2) who are equipped to observe and who agree to observe such safety standards to protect health and to minimize danger to life or property as the Commission may by rule establish; and (3) who agree to make available to the Commission such technical information and data concerning activities under such license as the Commission may determine necessary to promote the common defense and security and to protect the health and safety of the public. All such information may be used by the Commission only for the purposes of the common defense and security and to protect the health and safety of the public.

"c. Each such license shall be issued for a specified period, as determined by the Commission, depending on the type of activity to be licensed, but not exceeding forty years, and may be renewed upon the expiration of such period.

"d. No license under this section may be given to any person for activities which are not under or within the jurisdiction of the United States, except for the export of production or utilization facilities under terms of an agreement for cooperation arranged pursuant to section 123, or except under the provisions of section 109. No license may be issued to an alien or any [43] corporation or other entity if the Commission knows or has reason to believe it is owned, controlled, or dominated by an alien, a foreign corporation, or a foreign government. In any event, no license may be issued to any person within the United States if, in the opinion of the Commission, the issuance of a license to such person would be inimical to the common defense and security or to the health and safety of the public.

"f.[44] Each license issued for a utilization facility under this section or section 104 b. shall require as a condition thereof that in case of any accident which could result in an unplanned release of quantities of fission products in excess of allowable limits for normal operation established by the Commission, the licensee shall immediately so notify the Commission. Violation of the condition prescribed by this subsection may, in the Commission's discretion, constitute grounds for license revocation. In accordance with section 187 of this Act, the Commission shall promptly amend each license for a utilization facility issued under this section or section 104 b. which is in effect on the date of enactment of this subsection to include the provision required under this subsection.

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[41] Public Law 84-1006 (70 Stat. 1069), sec. 12, added the word "use.".

[42] Public Law 91-650 (84 Stat. 1472) (1970), sec. 4, amended the first sentence of sec. 103 a. Before amendment it read as follows:

"Subsequent to a finding by the Commission as required in section 102, the Commission may issue licenses to transfer or receive in interstate commerce, manufacture, produce, transfer, acquire, possess, use, import, or export under the terms of an agreement for cooperation arranged pursuant to section 123, such type of utilization or production facility."

[43] Public Law 84-1006 (70 Stat. 1069) (1956), sec. 13, added the words "an alien or any" between the words "to" and "any" in the second sentence of subsec. 103 d.

[44] Subsec. f. was added by sec. 201(a) of Public Law 96-295 (94 Stat. 786).

"Sec. 104. Medical Therapy and Research and Development.—

"a. The Commission is authorized to issue licenses to persons applying therefor for utilization facilities for use in medical therapy. In issuing such licenses the Commission is directed to permit the widest amount of effective medical therapy possible with the amount of special nuclear material available for such purposes and to impose the minimum amount of regulation consistent with its obligations under this Act to promote the common defense and security and to protect the health and safety of the public.

"b.[45] As provided for in subsection 102 b. or 102 c., or where specifically authorized by law, the Commission is authorized to issue licenses under this subsection to persons applying therefor for utilization and production facilities for industrial and commercial purposes. In issuing licenses under this subsection, the Commission shall impose the minimum amount of such regulations and terms of license as will permit the Commission to fulfill its obligations under this Act.

"c. The Commission is authorized to issue licenses to persons applying therefor for utilization and production facilities useful in the conduct of research and development activities of the types specified in section 31 and which are not facilities of the type specified in subsection 104 b. The Commission is directed to impose only such minimum amount of regulation of the licensee as the Commission finds will permit the Commission to fulfill its obligations under this Act to promote the common defense and security and to protect the health and safety of the public and will permit the conduct of widespread and diverse research and development.

"d. No license under this section may be given to any person for activities which are not under or within the jurisdiction of the United States, except for the export of production or utilization facilities under terms of an agreement for cooperation arranged pursuant to section 123 or except under the provisions of section 109. No license may be issued to any corporation or other entity if the Commission knows or has reason to believe it is owned, controlled, or dominated by an alien, a foreign corporation, or a foreign government. In any event, no license may be issued to any person within the United States if, in the opinion of the Commission, the issuance of a license to such person would be inimical to the common defense and security or to the health and safety of the public.

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[45] Public Law 91-560 (84 Stat. 1472) (1970), sec. 5, amended subsection 104 b. Before amendment it read as follows:

"b. The Commission is authorized to issue licenses to persons applying therefor for utilization and production facilities involved in the conduct of research and development activities leading to the demonstration of the practical value of such facilities for industrial or commercial purposes. In issuing licenses under this subsection, the Commission shall impose the minimum amount of such regulations and terms of license as will permit the Commission to fulfill its obligations under this Act to promote the common defense and security and to protect the health and safety of the public and will be compatible with the regulations and terms of license which would apply in the event that a commercial license were later to be issued pursuant to section 103 for that type of facility. In issuing such licenses, priority shall be given to those activities which will, in the opinion of the Commission, lead to major advances in the application of atomic energy for industrial or commercial purposes."

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"**Sec. 109.**[46] **Component and Other Parts of Facilities.**—

"a. With respect to those utilization and production facilities which are so determined by the Commission pursuant to subsection 11 v. (2) or 11 cc. (2) the Commission may issue general licenses for domestic activities required to be licensed under section 101, if the Commission determines in writing that such general licensing will not constitute an unreasonable risk to the common defense and security.

"b. After consulting with the Secretaries of State, Energy, and Commerce and the Director, the Commission is authorized and directed to determine which component parts as defined in subsection 11 v. (2) or 11 cc. (2) and which other items or substances are especially relevant from the standpoint of export control because of their significance for nuclear explosive purposes. Except as provided in section 126 b. (2), no such component, substance, or item which is so determined by the Commission shall be exported unless the Commission issues a general or specific license for its export after finding, based on a reasonable judgment of the assurances provided and other information available to the Federal Government, including the Commission, that the following criteria or their equivalent are met: (1) IAEA safeguards as required by Article III (2) of the Treaty will be applied with respect to such component, substance, or item; (2) no such component, substance, or item will be used for any nuclear explosive device or for research on or development of any nuclear explosive device; and (3) no such component, substance, or item will be retransferred to the jurisdiction of any other nation or group of nations unless the prior consent of the United States is obtained for such retransfer; and after determining in writing that the issuance of each such general or specific license or category of licenses will not be inimical to the common defense and security: *Provided*, That a specific license shall not be required for an export pursuant to this section if the component, item or substance is covered by a facility license issued pursuant to section 126 of this Act.

"c. The Commission shall not issue an export license under the authority of subsection b. if it is advised by the executive branch, in accordance with the procedures established under subsection 126 a., that the export would be inimical to the common defense and security of the United States.

"Sec. 111.[47] a. The Nuclear Regulatory Commission is authorized to license the distribution of special nuclear material, source material, and byproduct material by the Department of Energy pursuant to sections 54, 64, and 82 of this Act, respectively, in accordance with the same procedures established by law for the export licensing of such material by any person: *Provided*, That nothing in this section shall require the licensing of the distribution of byproduct material by the Department of Energy under section 82 of this Act.

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[46] Sec. 109 was amended and restated by sec. 309(a) of the Nuclear Non-Proliferation Act of 1978 (92 Stat. 141). Sec 309(b) of that act also instructed the Commission to publish regulations to implement the provisions of subsecs. b and c of sec. 109. Sec. 309(d) of that same act also stated that the amendments to sec. 109 would not affect the approval of exports contracted for prior to Nov. 1, 1977, which are made by Mar. 10, 1979.

[47] Sec. 111 was added by sec. 301(c) of the Nuclear Non-Proliferation Act of 1978 (92 Stat. 125).

"b. The Department of Energy shall not distribute any special nuclear material or source material under section 54 or 64 of this Act other than under an export license issued by the Nuclear Regulatory Commission until (1) the Department has obtained the concurrence of the Department of State and has consulted with the Arms Control and Disarmament Agency, the Nuclear Regulatory Commission, and the Department of Defense under mutually agreed procedures which shall be established within not more than ninety days after the date of enactment of this provision and (2) the Department finds based on a reasonable judgment of the assurances provided and the information available to the United States Government, that the criteria in section 127 of this Act or their equivalent and any application criteria in subsection 128 are met, and that the proposed distribution would not be inimical to the common defense and security.

"CHAPTER 11. INTERNATIONAL ACTIVITIES

"Sec. 121. Effect of International Arrangements.—Any provision of this Act or any action of the Commission to the extent and during the time that it conflicts with the provisions of any international arrangement made after the date of enactment of this Act shall be deemed to be of no force or effect.

"Sec. 122. Policies Contained in International Arrangements.—In the performance of its functions under this Act, the Commission shall give maximum effect to the policies contained in any international arrangement made after the date of enactment of this Act.

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"Sec. 123.[48] Cooperation With Other Nations.—

"No cooperation with any nation, group of nations or regional defense organization pursuant to section 53, 54 a., 57, 64, 82, 91, 103, 104, or 144 shall be undertaken until—

"a. the proposed agreement for cooperation has been submitted to the President, which proposed agreement shall include the terms, conditions, duration, nature, and scope of the cooperation; and shall include the following requirements:

"(1) a guaranty by the cooperating party that safeguards as set forth in the agreement for cooperation will be maintained with respect to all nuclear materials and equipment transferred pursuant thereto, and with respect to all special nuclear material used in or produced through the use of such nuclear materials and equipment, so long as the material or equipment remains under the jurisdiction or control of the cooperating party, irrespective of the duration of other provisions in the agreement or whether the agreement is terminated or suspended for any reason;

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[48] Sec. 123, as previously amended by Public Law 85-479 (72 Stat. 276). Public Law 85-681 (72 Stat. 632), and Public Law 88-489 (78 Stat. 602), was further amended and restated by sec. 401 of the Nuclear Non-Proliferation Act of 1978 (92 Stat. 142). Sec. 405(a) of the 1978 Act also stated that these amendments to sec. 123 would not affect the authority to continue cooperation pursuant to agreements for cooperation entered into prior to Mar. 10, 1978. Sec. 407 also of the 1978 act specified that for any agreement entered into pursuant to sec. 123, the President shall strive to include in such agreement cooperation between the parties in protecting the international environment from radioactive, chemical or thermal contamination arising from peaceful nuclear activities.

"(2) in the case of non-nuclear-weapon states, a requirement, as a condition of continued United States nuclear supply under the agreement for cooperation, that IAEA safeguards be maintained with respect to all nuclear materials in all peaceful nuclear activities within the territory of such state, under its jurisdiction, or carried out under its control anywhere;

"(3) except in the case of those agreements for cooperation arranged pursuant to subsection 91 c., a guaranty by the cooperating party that no nuclear materials and equipment or sensitive nuclear technology to be transferred pursuant to such agreement, and no special nuclear material produced through the use of any nuclear materials and equipment or sensitive nuclear technology transferred pursuant to such agreement, will be used for any nuclear explosive device, or for research on or development of any nuclear explosive device, or for any other military purpose;

"(4) except in the case of those agreements for cooperation arranged pursuant to subsection 91 c. and agreements for cooperation with nuclear-weapon states, a stipulation that the United States shall have the right to require the return of any nuclear materials and equipment transferred pursuant thereto and any special nuclear material produced through the use thereof if the cooperating party detonates a nuclear explosive device or terminates or abrogates an agreement providing for IAEA safeguards;

"(5) a guaranty by the cooperating party that any material or any Restricted Data transferred pursuant to the agreement for cooperation and, except in the case of agreements arranged pursuant to subsection 91 c., 144 b. or 144 c., any production or utilization facility transferred pursuant to the agreement for cooperation or any special nuclear material produced through the use of any such facility or through the use of any material transferred pursuant to the agreement, will not be transferred to unauthorized persons or beyond the jurisidiction or control of the cooperating party without the consent of the United States;

"(6) a guaranty by the cooperating party that adequate physical security will be maintained with respect to any nuclear material transferred pursuant to such agreement and with respect to any special nuclear material used in or produced through the use of any material, production facility, or utilization facility transferred pursuant to such agreement;

"(7) except in the case of agreements for cooperation arranged pursuant to subsection 91 c., 144 b., or 144 c., a guaranty by the cooperating party that no material transferred pursuant to the agreement for cooperation and no material used in or produced through the use of any material, production facility, or utilization facility transferred pursuant to the agreement for cooperation will be reprocessed, enriched or (in the case of plutonium, uranium 233, or uranium enriched to greater than twenty percent in the isotope 235, or other nuclear material which have been irradiated) otherwise altered in form or content without the prior approval of the United States;

"(8) except in the case of agreements for cooperation arranged pursuant to subsection 91 c., 144 b., or 144 c., a guaranty by the cooperating party that no plutonium, no uranium 223, and no uranium enriched to greater than twenty percent in the isotope 235, transferred pursuant to the agreement for cooperation or recovered from any source or special nuclear material used in any production facility or utilization facility transferred pursuant to the agreement for cooperation, will be stored in any facility that has not been approved in advance by the United States; and

"(9) except in the case of agreements for cooperation arranged pursuant to subsection 91 c., 144 b., or 144 c., a guaranty by the cooperation party that any special nuclear material, production facility, or utilization facility produced or constructed under the jurisdiction of the cooperating party by or through the use of any sensitive nuclear technology transferred pursuant to such agreement for cooperation will be subject to all the requirements specified in this subsection.

The President may exempt a proposed agreement for cooperation (except an agreement arranged pursuant to subsection 91 c., 144 b., or 144 c.) from any of the requirements of the foregoing sentence if he determines that inclusion of any such requirement would be seriously prejudicial to the achievement of United States non-proliferation objectives or otherwise jeopardise that common defense and security. Except in the case of those agreements for cooperation arranged pursuant to subsection 91 c., 144 b., or 144 c., any proposed agreement for cooperation shall be negotiated by the Secretary of State, with the technical assistance and concurrence of the Secretary of Energy and in consultation with the Director of the Arms Control and Disarmament Agency ('the Director'); and after consultation with the Commission shall be submitted to the President jointly by the Secretary of State and the Secretary of Energy accompanied by the views and recommendation of the Secretary of State, the Secretary of Energy, the Nuclear Regulatory Commission, and the Director, who shall also provide to the President an unclassified Nuclear Proliferation Assessment Statement regarding the adequacy of the safeguards and other control mechanisms and the peaceful use assurances contained in the agreement for cooperation to ensure that any assistance furnished thereunder will not be used to further any military or nuclear explosive purpose. In the case of those agreements for cooperation arranged pursuant to subsection 91 c., 144 b., or 144 c., any proposed agreement for cooperation shall be submitted to the President by the Secretary of Energy or, in the case of those agreements for cooperation arranged pursuant to subsection 91 c., or 144 b. which are to be implemented by the Department of Defense, by the Secretary of Defense;

"b. the President has approved and authorized the execution of the proposed agreement for cooperation and has made a determination in writing that the performance of the proposed agreement will promote, and will not constitute an unreasonable risk to, the common defense and security;

"c. the proposed agreement for cooperation (if not an agreement subject to subsection d.), together with the approval and determination of the President, has been submitted to the Committee on International Relations of the House of Representatives and the Committee on Foreign Relations of the Senate for a period of thirty days of continuous session (as defined in subsection 130 g.): *Provided*, *however*, That these committees, after having received such agreement for cooperation, may by resolution in writing waive the conditions of all or any portion of such thirty-day period; and

"d. the proposed agreement for cooperation (if arranged pursuant to subsection 91 c., 144 b., or 144 c., or if entailing implementation of section 53, 54 a., 103, or 104 in relation to a reactor that may be capable of producing more than five thermal megawatts or special nuclear material for use in connection therewith) has been submitted to the Congress, together with the approval and determination of the President, for a period of sixty days of continuous session (as defined in subsection 130 g. of this Act) and referred to the Committee on International Relations of the House of Representatives and the Committee on Foreign Relations of the Senate, and in addition, in the case of a proposed agreement for cooperation arranged pursuant to subsection 91 c., 144 b., or 144 c., the Committee on Armed Services of the House of Representatives and the Committee on Armed Services of the Senate, but such proposed agreement for cooperation shall not become effective if during such sixty-day period the Congress adopts a concurrent resolution stating in substance that the Congress does not favor the proposed agreement for cooperation: *Provided*, That the sixty-day period shall not begin until a Nuclear Proliferation Assessment Statement prepared by the Director of the Arms Control and Disarmament Agency, when required by subsection 123 a., has been submitted to the Congress. Any such proposed agreement for cooperation shall be considered pursuant to the procedures set forth in section 130 of this Act for the consideration of Presidential submissions.

"Following submission of a proposed agreement for cooperation (except an agreement for cooperation arranged pursuant to subsection 91 c., 144 b., or 144 c.) to the Committee on International Relations of the House of Representatives and the Committee on Foreign Relations of the Senate, the Nuclear Regulatory Commission, the Department of State, the Department of Energy, the Arms Control and Disarmament Agency, and the Department of Defense shall, upon the request of either of those committees, promptly furnish to those committees their views as to whether the safeguards and other controls contained therein provide an adequate framework to ensure that any exports as comtemplated by such agreement will not be inimical to or constitute an unreasonable risk to the common defense and security.

"If, after the date of enactment of the Nuclear Non-Proliferation Act of 1978, the Congress fails to disapprove a proposed agreement for cooperation which exempts the recipient nation from the requirement set forth in subsection 123 a. (2), such failure to act shall constitute a failure to adopt a resolution of disapproval pursuant to subsection 128 b. (3) for purposes of the Commission's consideration of applications and requests under section 126 a. (2) and there shall be no congressional review pursuant to section 128 of any subsequent license or authorization with respect to that state until the first such license or authorization which is issued after twelve months from the elapse of the sixty-day period in which the agreement for cooperation in question is reviewed by the Congress.".

"**Sec. 124. International Atomic Pool.**—The President is authorized to enter into an international arrangement with a group of nations providing for international cooperation in the nonmilitary applications of atomic energy and he may thereafter cooperate with that group of nations pursuant to sections 54 a., 57, 64, 82, 103, 104, or 114 a.: *Provided, however*, That the cooperation is undertaken pursuant to an agreement for cooperation entered into in accordance with section 123.

Sec. 125.[49] Cooperation With Berlin.—The President may authorize the Commission to enter into agreement for cooperation with the Federal Republic of Germany in accordance with section 123, on behalf of Berlin, which for the purposes of this Act comprises those areas over which the Berlin Senate exercises jurisdiction (the United States, British, and French sectors) and the Commission may thereafter cooperate with Berlin pursuant to sections 54 a., 57, 64, 82, 103, or 104: *Provided*, That the guaranties required by section 123 shall be made by Berlin with the approval of the allied commandants.

"**Sec. 126.[50] Export Licensing Procedures.**—

"a. No license may be issued by the Nuclear Regulatory Commission (the 'Commission') for the export of any production or utilization facility, or any source material or special nuclear material, including distributions of any material by the Department of Energy under section 54, 64, or 82, for which a license is required or requested, and no exemption from any requirement for such an export license may be granted by the Commission, as the case may be, until—

> "(1) The Commission has been notified by the Secretary of State that it is the judgment of the executive branch that the proposed export or exemption will not be inimical to the common defense and security, or that any export in the category to which the proposed export belongs would not be inimical to the common defense and security because it lacks significance for nuclear explosive purposes. The Secretary of State shall, within ninety days after the enactment of this section, establish orderly and expeditious procedures, including provision for necessary administrative actions and inter-agency

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[49] Sec. 125 was added by Public Law 85-14 (71 Stat. 11).

[50] Sec. 126 was added by sec. 304(a) of the Nuclear Non-Proliferation Act of 1978 (92 Stat. 131).

memoranda of understanding, which are mutually agreeable to the Secretaries of Energy, Defense, and Commerce, the Director of the Arms Control and Disarmament Agency, and the Nuclear Regulatory Commission for the preparation of the executive branch judgment on export applications under this section.[81] Such procedures shall include, at a minimum, explicit direction on the handling of such applications, express deadlines for the solicitation and collection of the views of the consulted agencies (with identified officials responsible for meeting such deadlines), an inter-agency coordinating authority to monitor the processing of such applications, predetermined procedures for the expeditious handling of intra-agency and inter-agency disagreements and appeals to higher authorities, frequent meetings of inter-agency administrative coordinators to review the status of all pending applications, and similar administrative mechanisms. To the extent practicable, an applicant should be advised of all the information required of the applicant for the entire process for every agency's needs at the beginning of the process. Potentially controversial applications should be identified as quickly as possible so that any required policy decisions or diplomatic consultations can be initiated in a timely manner. An immediate effort should be undertaken to establish quickly any necessary standards and criteria, including the nature of any required assurances or evidentiary showings, for the decisions required under this section. The processing of any export application proposed and filed as of the date of enactment of this section shall not be delayed pending the development and establishment of procedures to implement the requirements of this section. The executive branch judgment shall be completed in not more than sixty days from receipt of the application or request, unless the Secretary of State in his discretion specifically authorizes additional time for consideration of the application or request because it is in the national interest to allow such additional time. The Secretary shall notify the Committee on Foreign Relations of the Senate and the Committee on International Relations of the House of Representatives of any such authorization. In submitting any such judgment, the Secretary of State shall specifically address the extent to which the export criteria then in effect are met and the extent to which the cooperating party has adhered to the provision of the applicable agreement for cooperation. In the event he considers it warranted, the Secretary may also address the following additional factors, among others:

"(A) whether issuing the license or granting the exemption will materially advance the non-proliferation policy of the United States by encouraging the recipient nation to adhere to the Treaty, or to participate in the undertakings contemplated by section 403 or 404(a) of the Nuclear Non-Proliferation Act of 1978;

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[81] Such procedures were issued June 1, 1978. For text, see Vol. III, page 647.

"(B) whether failure to issue the license or grant the exemption would otherwise be seriously prejudicial to the non-proliferation objectives of the United States; and

"(C) whether the recipient nation or group of nations has agreed that conditions substantially identical to the export criteria set forth in section 127 of this Act will be applied by another nuclear supplier nation or group of nations to the proposed United States export, and whether in the Secretary's judgment those conditions will be implemented in a manner acceptable to the United States.

The Secretary of State shall provide appropriate data and recommendations, subject to requests for additional data and recommendations, as required by the Commission or the Secretary of Energy, as the case may be; and

"(2) the Commission finds, based on a reasonable judgment of the assurances provided and other information available to the Federal Government, including the Commission, that the criteria in section 127 of this Act or their equivalent, and any other applicable statutory requirements, are met: *Provided*, That continued cooperation under an agreement for cooperation as authorized in accordance with section 124 of this Act shall not be prevented by failure to meet the provisions of paragraph (4) or (5) of section 127 for a period of thirty days after enactment of this section, and for a period of twenty-three months thereafter if the Secretary of State notifies the Commission that the nation or group of nations bound by the relevant agreement has agreed to negotiations as called for in section 404(a) of the Nuclear Non-Proliferation Act of 1978; however, nothing in this subsection shall be deemed to relinquish any rights which the United States may have under agreements for cooperation in force on the date of enactment of this section: *Provided further*, That if, upon the expiration of such twenty-four month period, the President determines that failure to continue cooperation with any group of nations which has been exempted pursuant to the above proviso from the provisions of paragraph (4) or (5) of section 127 of this Act, but which has not yet agreed to comply with those provisions would be seriously prejudicial to the achievement of United States non-proliferation objectives or otherwise jeopardize the common defense and security, he may, after notifying the Congress of his determination, extend by Executive order the duration of the above proviso for a period of twelve months, and may further extend the duration of such proviso by one year increments annually thereafter if he again makes such determination and so notifies the Congress. In the event that the Committee on International Relations of the House of Representatives or the Committee on Foreign Relations of the Senate reports a joint resolution to take any action with respect to any such extension, such joint resolution will be considered in the House or Senate, as the case may be, under procedures identical to those provided for the consideration of resolutions pursuant to section 130 of this Act; *And additionally provided*, That the Commission is authorized to (A) make a single finding under this subsection for more than a single application or request, where the applications or requests involve exports to the same country, in the same general time frame, of similar significance for nuclear explosive purposes and under reasonably similar circumstances and (B) make a finding under this subsection that there is no materially changed circumstance associated with a new application or request from those existing at the time of the last application or request for an export to the same country, where the prior application or request was approved by the Commission using all applicable procedures of this section, and such finding of no materially changed circumstance shall be deemed to satisfy the requirement of this paragraph for findings of the Commission. The decision not to make any such findings in lieu of the findings which would otherwise be required to be made under this paragraph shall not be subject to judicial review: *And provided further,* That nothing contained in this section is intended to require the Commission independently to conduct or prohibit the Commission from independently conducting country or site specific visitations in the Commission's consideration of the application of IAEA safeguards.

"b. (1) Timely consideration shall be given by the Commission to requests for export licenses and exemptions and such requests shall be granted upon a determination that all applicable statutory requirements have been met.

"(2) If, after receiving the executive branch judgment that the issuance of a proposed export license will not be inimical to the common defense and security, the Commission does not issue the proposed license on a timley basis because it is unable to make the statutory determinations required under this Act, the Commission shall publicly issue its decision to that effect, and shall submit the license application to the President. The Commission's decision shall include an explanation of the basis for the decision and any dissenting or separate views. If, after receiving the proposed license application and reviewing the Commission's decision, the President determines that withholding the proposed export would be seriously prejudicial to the achievement of United States non-proliferation objectives, or would otherwise jeopardize the common defense and security, the proposed export may be authorized by Executive order.[88] *Provided,* That prior to any such export, the President shall submit the Executive order, together with his explanation of why, in light of the Commission's decision, the export should nonetheless be made, to the Congress for a period of sixty days or continuous session (as defined in subsection 130 g.) and shall be referred to the Committee on International Relations of the House of Representatives and the Committee on Foreign Relations of the Senate, but any such proposed export shall not occur if during such sixty-day period the Congress adopts a concurrent resolution stating in substance that it does not favor the proposed export. Any such Executive order shall be considered pursuant to the procedures set forth in section 130 of this Act for the consideration of Presidential submissions: *And provided further,* That the procedures established pursuant to subsection (b) of section 304 of the Nuclear Non-Proliferation Act of 1978 shall provide that the Commission shall immediately initiate review of any application for a license under this section and to the maximum extent feasible shall expeditiously process the application concurrently with the executive branch review, while awaiting the final executive branch judgment. In initiating its review, the Commission may identify a set of concerns and requests for information associated with the projected issuance of such licenses and shall transmit such concerns and requests to the executive branch which shall address such concerns and requests in its written communications with the Commission. Such procedures shall also provide that if the Commission has not completed action on the application within sixty days after the receipt of an executive branch judgment that the proposed export or exemption is not inimical to the common defense and security or that any export in the category to which the proposed export beings would not be inimical to the common defense and security because it lacks significance for nuclear explosive purposes, the Commission shall inform the applicant in writing of the reason for delay and provide follow-up reports as appropriate. If the Commission has not completed action by the end of any additional sixty days (a total of one hundred and twenty days from receipt of the executive branch judgment), the President may authorize the proposed export by Executive order, upon a finding that further delay would be excessive and upon making the findings required for such Presidential authorizations under this subsection, and subject to the Congressional review procedures set forth herein. However, if the Commission has commenced procedures for public participation regarding the proposed export under regulations promulgated pursuant to subsection (b) of section 304 of the Nuclear Non-Proliferation Act of 1978, or—within sixty days after receipt of the executive branch judgment on the proposed export—the Commission has identified and transmitted to the executive branch a set of additional concerns or requests for information, the President may not authorize the proposed export until sixty days after public proceedings are completed or sixty days after a full executive branch response to the Commission's additional concerns or requests has been made consistent with subsection a. (1) of this section: *Provided further,* That nothing in this section shall affect the right of the Commission to obtain data and recommendations from the Secretary of State at any time as provided in subsection a. (1) of this section.

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[88] Pursuant to Presidential Memorandum of Oct. 3, 1980 (45 F.R. 67629), the Secretary of State is authorized to determine the "time, terms, and conditions of exports made pursuant to any Executive Order" issued under this paragraph. This memorandum also authorized the Secretary, on behalf of the President, to issue "such rules, regulations and procedures" as he may deem necessary in order to exercise the functions delegated to him by the memorandum.

"c. In the event that the House of Representatives or the Senate passes a joint resolution which would adopt one or more additional export criteria, or would modify any existing export criteria under this Act, any such joint resolution shall be referred in the other House to the Committee on Foreign Relations of the Senate or the Committee on International Relations of the House of Representatives, as the case may be, and shall be considered by the other House under applicable procedures provided for the consideration of resolutions pursuant to section 130 of this Act.

"Sec. 127.[53] Criteria Governing United States Nuclear Exports.—

"The United States adopts the following criteria which, in addition to other requirements of law, will govern exports for peaceful nuclear uses from the United States of source material, special nuclear material, production or utilization facilities, and any sensitive nuclear technology:

"(1) IAEA safeguards as required by Article III(2) of the Treaty will be applied with respect to any such material or facilities proposed to be exported, to any such material or facilities proposed to be exported, to any such material or facilities previously exported and subject to the applicable agreement for cooperation, and to any special nuclear material used in or produced through the use thereof.

"(2) No such material, facilities, or sensitive nuclear technology proposed to be exported or previously exported and subject to the applicable agreement for cooperation, and no special nuclear material produced through the use of such materials, facilities, or sensitive nuclear technology, will be used for any nuclear explosive device or for research on or development of any nuclear explosive device.

"(3) Adequate physical security measures will be maintained with respect to such material or facilities proposed to be exported and to any special nuclear material used in or produced through the use thereof. Following the effective date of any regulations promulgated by the Commission pursuant to section 304(d) of the Nuclear Non-Proliferation Act of 1978, physical security measures shall be deemed adequate if such measures provide a level of protection equivalent to that required by the applicable regulations.

"(4) No such materials, facilities, or sensitive nuclear technology proposed to be exported, and no special nuclear material produced through the use of such material, will be retransferred to the jurisdiction of any other nation or group of nations unless the prior approval of the United States is obtained for such retransfer. In addition to other requirements of law, the United States may approve such retransfer only if the nation or group of nations designated to receive such retransfer agrees that it shall be subject to the conditions required by this section.

"(5) No such material proposed to be exported and no special nuclear material produced through the use of such material will be reprocessed, and no irradiated fuel elements containing such material removed from a reactor shall be altered in form or content, unless the prior approval of the United States is obtained for such reprocessing or alteration.

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[53] Sec. 127 was added by sec. 305 of the Nuclear Non-Proliferation Act of 1978 (92 Stat 136).

"(6) No such sensitive nuclear technology shall be exported unless the foregoing conditions shall be applied to any nuclear material or equipment which is produced or constructed under the jurisdiction of the recipient nation or group of nations by or through the use of any such exported sensitive nuclear technology.

"Sec. 128.[84] Additional Export Criterion and Procedures.—

"a. (1) As a condition of continued United States export of source material, special nuclear material, production or utilization facilities, and any sensitive nuclear technology to non-nuclear-weapon states, no such export shall be made unless IAEA safeguards are maintained with respect to all peaceful nuclear activities in, under the jurisdiction of, or carried out under the control of such state at the time of the export.

"(2) The President shall seek to achieve adherence to the foregoing criterion by recipient non-nuclear-weapon states.

"b. The criterion set forth in subsection a. shall be applied as an export criterion with respect to any application for the export of materials, facilities, or technology specified in subsection a. which is filed after eighteen months from the date of enactment of this section, or for any such application under which the first export would occur at least twenty-four months after the date of enactment of this section, except as provided in the following paragraphs:

"(1) If the Commission or the Department of Energy, as the case may be, is notified that the President has determined that failure to approve an export to which this subsection applies because such criterion has not yet been met would be seriously prejudicial to the achievement of United States non-proliferation objectives or otherwise jeopardize the common defense and security, the license or authorization may be issued subject to other applicable requirements of law: *Provided*, That no such export of any production or utilization facility or of any source or special nuclear material (intended for use as fuel in any production or utilization facility) which has been licensed or authorized pursuant to this subsection shall be made to any non-nuclear-weapon state which has failed to meet such criterion until the first such license or authorization with respect to such state is submitted to the Congress (together with a detailed assessment of the reasons underlying the President's determination, the judgment of the executive branch required under section 126 of this Act, and any Commission opinion and views) for a period of sixty days of continuous session (as defined in subsection 130 g. of this Act) and referred to the Committee on International Relations of the House of Representatives and the Committee on Foreign Relations of the Senate, but such export shall not occur if during such sixty-day period the Congress adopts a concurrent resolution stating in substance that the Congress does not favor the proposed export. Any such license or authorization shall be considered pursuant to the procedures set forth in section 130 of this Act for the consideration of Presidential submissions.

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[84] Sec. 128 was added by sec. 306 of the Non-Proliferation Act of 1978 (92 Stat. 137).

"(2) If the Congress adopts a resolution of disapproval pursuant to paragraph (1), no further export of materials, facilities, or technology specified in subsection a. shall be permitted for the remainder of that Congress, unless such state meets the criterion or the President notifies the Congress that he has determined that significant progress has been made in achieving adherence to such criterion by such state or that United States foreign policy interests dictate reconsideration and the Congress, pursuant to the procedure of paragraph (1), does not adopt a concurrent resolution stating in substance that it disagrees with the President's determination.

"(3) If the Congress does not adopt a resolution of disapproval with respect to a license or authorization submitted pursuant to paragraph (1), the criterion set forth in subsection a. shall not be applied as an export criterion with respect to exports of materials, facilities and technology specified in subsection a. to that state: *Provided*, That the first license or authorization with respect to that state which is issued pursuant to this paragraph after twelve months from the elapse of the sixty-day period specified in paragraph (1), and the first such license or authorization which is issued after each twelve-month period thereafter, shall be submitted to the Congress for review pursuant to the procedures specified in paragraph (1): *Provided further*, That if the Congress adopts a resolution of disapproval during any review period provided for by this paragraph, the provisions of paragraph (2) shall apply with respect to further exports to such state.

"Sec. 129.[88] Conduct Resulting in Termination of Nuclear Exports.—

"No nuclear materials and equipment or sensitive nuclear technology shall be exported to—

"(1) any non-nuclear-weapon state that is found by the President to have, at any time after the effective date of this section,

"(A) detonated a nuclear explosive device; or

"(B) terminated or abrogated IAEA safeguards; or

"(C) materially violated an IAEA safeguards agreement; or

"(D) engaged in activities involving source or special nuclear material and having direct significance for the manufacture or acquisition of nuclear explosive devices, and has failed to take steps which, in the President's judgment, represent sufficient progress toward terminating such activities; or

"(2) any nation or group of nations that is found by the President to have, at any time after the effective date of this section,

"(A) materially violated an agreement for cooperation with the United States, or, with respect to material or equipment not supplied under an agreement for cooperation, materially violated the terms under which such material or equipment was supplied or the terms of any commitments obtained with respect thereto pursuant to section 402(a) of the Nuclear Non-Proliferation Act of 1978; or

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[88] Sec. 129 was added by sec. 307 of the Nuclear Non-Proliferation Act of 1978 (92 Stat. 138).

"(B) assisted, encouraged, or induced any non-nuclear-weapon state to engage in activities involving source or special nuclear material and having direct significance for the manufacture or acquisition of nuclear explosive devices, and has failed to take steps which, in the President's judgment, represent sufficient progress toward terminating such assistance, encouragement, or inducement; or

"(C) entered into an agreement after the date of enactment of this section for the transfer of reprocessing equipment, materials, or technology to the sovereign control of a non-nuclear-weapon state except in connection with an international fuel cycle evaluation in which the United States is a participant or pursuant to a subsequent international agreement or understanding to which the United States subscribes;

unless the President determines that cessation of such exports would be seriously prejudicial to the achievement of United States nonproliferation objectives or otherwise jeopardize the common defense and security: *Provided*, That prior to the effective date of any such determination, the President's determination, together with a report containing the reasons for his determination, shall be submitted to the Congress and referred to the Committee on International Relations of the House of Representatives and the Committee on Foreign Relations of the Senate for a period of sixty days of continuous session (as defined in subsection 130 g. of this Act.), but any such determination shall not become effective if during such sixty-day period the Congress adopts a concurrent resolution stating in substance that it does not favor the determination. Any such determination shall be considered pursuant to the procedures set forth in section 130 of this Act for the consideration of Presidential submissions

* "Sec. 130.[**] Congressional Review Procedures.—

"a. Not later than forty-five days of continuous session of Congress after the date of transmittal to the Congress of any submission of the President required by subsection 123 d., 126 a. (2), 126 b. (2), 128 b., 129, 131 a. (3), or 131 f. (1)(A) of this Act, the Committee on Foreign Relations of the Senate and the Committee on International Relations of the House of Representatives, and in addition, in the case of a proposed agreement for cooperation arranged pursuant to subsection 91 c., 144 b., or 144 c., the Committee on Armed Services of the House of Representatives and the Committee on Armed Services of the Senate, shall each submit a report to its respective House on its views and recommendations respecting such Presidential submission together with a resolution, as defined in subsection f., stating in substance that the Congress approves or disapproves such submission, as the case may be: *Provided*, That if any such committee has not reported such a resolution at the end of such forty-five day period, such committee shall be deemed to be discharged from further consideration of such submission and if, in the case of a proposed agreement for cooperation arranged pursuant to subsection 91 c., 144 b., or 144 c. of this Act, the other relevant committee of that House has reported such a resolution, such committee shall be deemed discharged from further consideration of that resolution. If no such resolution has been reported at the end of such period, the first resolution, as defined in subsection f., which is introduced within five days thereafter within such House shall be placed on the appropriate calendar of such House.

[**] Sec. 130 was added by sec. [illegible] of the Nuclear Non-Proliferation Act of 1978 (92 Stat. [illegible]).

* On June 23, 1983, the Supreme Court in INS v. Chadha (103 S.Ct. 2764) declared unconstitutional legislative vetoes of the type contained in Sec. 130.

"b. When the relevant committee or committees have reported such a resolution (or have been discharged from further consideration of such a resolution pursuant to subsection a.) or when a resolution has been introduced and placed on the appropriate calendar pursuant to subsection a., as the case may be, it is at any time thereafter in order (even though a previous motion to the same effect has been disagreed to) for any Member of the respective House to move to proceed to the consideration of the resolution. The motion is highly privileged and is not debatable. The motion shall not be subject to amendment, or to a motion to postpone, or to a motion to proceed to the consideration of other business. A motion to reconsider the vote by which the motion is agreed to or disagreed to shall not be in order. If a motion to proceed to the consideration of the resolution is agreed to, the resolution shall remain the unfinished business of the respective House until disposed of.

"c. Debate on the resolution, and on all debatable motions and appeals in connection therewith, shall be limited to not more than ten hours, which shall be divided equally between individuals favoring and individuals opposing the resolution. A motion further to limit debate is in order and not debatable. An amendment to a motion to postpone, or a motion to recommit the resolution, or a motion to proceed to the consideration of other business is not in order. A motion to reconsider the vote by which the resolution is agreed to or disagreed to shall not be in order. No amendment to any concurrent resolution pursuant to the procedures of this section is in order except as provided in subsection d.

"d. Immediately following (1) the conclusion of the debate on such concurrent resolution, (2) a single quorum call at the conclusion of debate if requested in accordance with the rules of the appropriate House, and (3) the consideration of an amendment introduced by the Majority Leader or his designee to insert the phrase, 'does not' in lieu of the word 'does' if the resolution under consideration is a concurrent resolution of approval, the vote on final approval of the resolution shall occur.

"e. Appeals from the decisions of the Chair relating to the application of the rules of the Senate or the House of Representatives, as the case may be, to the procedure relating to such a resolution shall be decided without debate.

"f. For the purposes of subsections a. through e. of this section, the term 'resolution' means a concurrent resolution of the Congress, the matter after the resolving clause of which is as follows: 'That the Congress (does or does not) favor the .... transmitted to the Congress by the President on ...., ...', the blank spaces therein to be appropriately filled, and the affirmative or negative phrase within the parenthetical to be appropriately selected.

"g. For the purposes of this section—

"(1) continuity of session is broken only by an adjournment of Congress sine die; and

"(2) the days on which either House is not in session because of an adjournment of more than three days to a day certain are excluded in the computation of any period of time in which Congress is in continuous session.

"h. This section is enacted by Congress—

"(1) as an exercise of the rulemaking power of the Senate and the House of Representatives, respectively, and as such they are deemed a part of the rules of each House, respectively, but applicable only with respect to the procedure to be followed in that House in the case of resolutions described by subsection f. of this section; and they supersede other rules only to the extent that they are inconsistent therewith; and

"(2) with full recognition of the constitutional right of either House to change the rules (so far as relating to the procedure of that House) at any time, in the same manner and to the same extent as in the case of any other rule of that House.

"Sec. 131.[57] Subsequent Arrangements.—

"a. (1) Prior to entering into any proposed subsequent arrangement under an agreement for cooperation (other than an agreement for cooperation arranged pursuant to subsection 91 c., 144 b., or 144 c. of this Act), the Secretary of Energy shall obtain the concurrence of the Secretary of State and shall consult with the Director, the Commission, and the Secretary of Defense: *Provided*, That the Secretary, of State shall have the leading role in any negotiations of a policy nature pertaining to any proposed subsequent arrangement regarding arrangements for the storage or disposition of irradiated fuel elements or approvals for the transfer, for which prior approval is required under an agreement for cooperation, by a recipient of source or special nuclear material, production or utilization facilities, or nuclear technology. Notice of any proposed subsequent arrangement shall be published in the Federal Register, together with the written determination of the Secretary of Energy that such arrangement will not be inimical to the common defense and security, and such proposed subsequent arrangement shall not take effect before fifteen days after publication. Whenever the Director declares that he intends to prepare a Nuclear Proliferation Assessment Statement pursuant to paragraph (2) of this subsection, notice of the proposed subsequent arrangement which is the subject of the Director's declaration shall not be published until after the receipt by the Secretary of Energy of such Statement or the expiration of the time authorized by subsection c. for the preparation of such Statement, whichever occurs first.[58]

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[57] Sec. 131 was added by sec. 303(a) of the Nuclear Non-Proliferation Act of 1978 (92 Stat. 127).

[58] Sec. 406 of the Nuclear Non-Proliferation Act of 1978 (92 Stat. 148) provides that "No court or regulatory body shall have any jurisdiction under any law to compel the performance of or to review the adequacy of the performance of any Nuclear Proliferation Assessment Statement called for in this Act or in the 1954 Act."

"(2) If in the Director's view a proposed subsequent arrangement might significantly contribute to proliferation, he may prepare an unclassified Nuclear Proliferation Assessment Statement [55] with regard to such proposed subsequent arrangement regarding the adequacy of the safeguards and other control mechanisms and the application of the peaceful use assurances of the relevant agreement to ensure that assistance to be furnished pursuant to the subsequent arrangement will not be used to further any military or nuclear explosive purpose. For the purposes of this section, the term 'subsequent arrangements' means arrangements entered into by any agency or department of the United States Government with respect to cooperation with any nation or group of nations (but not purely private or domestic arrangements) involving—

"(A) contracts for the furnishing of nuclear materials and equipment;

"(B) approvals for the transfer, for which prior approval is required under an agreement for cooperation, by a recipient of any source or special nuclear material, production or utilization facility, or nuclear technology;

"(C) authorization for the distribution of nuclear materials and equipment pursuant to this Act which is not subject to the procedures set forth in section 111 b., section 126, or section 109 b.;

"(D) arrangements for physical security;

"(E) arrangements for the storage or disposition of irradiated fuel elements;

"(F) arrangements for the application of safeguards with respect to nuclear materials and equipment; or

"(G) any other arrangement which the President finds to be important from the standpoint of preventing proliferation.

"(3) The United States will give timely consideration to all requests for prior approval, when required by this Act, for the reprocessing of material proposed to be exported, previously exported and subject to the applicable agreement for cooperation, or special nuclear material produced through the use of such material or a production or utilization facility transferred pursuant to such agreement for cooperation, or to the altering of irradiated fuel elements containing such material, and additionally, to the maximum extent feasible, will attempt to expedite such consideration when the terms and conditions for such actions are set forth in such agreement for cooperation or in some other international agreement executed by the United States and subject to congressional review procedures comparable to those set forth in section 123 of this Act.

"(4) All other statutory requirements under other sections of this Act for the approval or conduct of any arrangement subject to this subsection shall continue to apply and any other such requirements for prior approval or conditions for entering such arrangements shall also be satisified before the arrangement takes effect pursuant to subsection a. (1).

"b. With regard to any special nuclear material exported by the United States or produced through the use of any nuclear materials and equipment or sensitive nuclear technology exported by the United States—

"(1) the Secretary of Energy may not enter into any subsequent arrangement for the retransfer of any such material to a third country for reprocessing, for the reprocessing of any such material, or for the subsequent retransfer of any plutonium in quantities greater than 500 grams resulting from the reprocessing of any such material, until he has provided the Committee on International Relations of the House of Representatives and the Committee on Foreign Relations of the Senate with a report containing his reasons for entering into such arrangement and a period of 15 days of continuous session (as defined in subsection 130 g. of this Act) has elapsed: *Provided, however*, That if in the view of the President an emergency exists due to unforeseen circumstances requiring immediate entry into a subsequent arrangement, such period shall consist of fifteen calendar days;

"(2) the Secretary of Energy may not enter into any subsequent arrangement for the reprocessing of any such material in a facility which has not processed power reactor fuel assemblies or been the subject of a subsequent arrangement therefor prior to the date of enactment of the Nuclear Non-Proliferation Act of 1978 or for subsequent retransfer to a non-nuclear-weapon state of any plutonium in quantities greater than 500 grams resulting from such reprocessing, unless in his judgment, and that of the Secretary of State, such reprocessing or retransfer will not result in a significant increase of the risk of proliferation beyond that which exists at the time that approval is requested. Among all the factors in making this judgment, foremost consideration will be given to whether or not the reprocessing or retransfer will take place under conditions that will ensure timely warning to the United States of any diversion well in advance of the time at which the non-nuclear-weapon state could transform the diverted material into a nuclear explosive device; and

"(3) the Secretary of Energy shall attempt to ensure, in entering into any subsequent arrangement for the reprocessing of any such material in any facility that has processed power reactor fuel assemblies or been the subject of a subsequent arrangement therefor prior to the date of enactment of the Nuclear Non-Proliferation Act of 1978, or for the subsequent retransfer to any non-nuclear-weapon state of any plutonium in quantities greater than 500 grams resulting from such reprocessing, that such reprocessing or retransfer shall take place under conditions comparable to those which in this view, and that of the Secretary of State, satisfy the standards set forth in the paragraph (2).

"c. The Secretary of Energy shall, within ninety days after the enactment of this section, establish orderly and expeditious procedures, including provision for necessary administrative actions and inter-agency memoranda of understanding, which are mutually agreeable to the Secretaries of State, Defense, and Commerce, the Director of the Arms Control and Disarmament Agency, and the Nuclear Regulatory Commission for the consideration of requests for subsequent arrangements under this section.[69] Such procedures shall include, at a minimum, explicit direction on the handling of such requests, express deadlines for the solicitation and collection of the views of the consulted agencies (with identified officials responsible for meeting such deadlines), an inter-agency coordinating authority to monitor the processing of such requests, predetermined procedures for the expeditious handling of intra-agency and inter-agency disagreements and appeals to higher authorities, frequent meetings of inter-agency administrative coordinators to review the status of all pending requests, and similar administrative mechanisms. To the extent practicable, an applicant should be advised of all the information required of the applicant for the entire process for every agency's needs at the beginning of the process. Potentially controversial requests should be identified as quickly as possible so that any required policy decisions or diplomatic consultations can be initiated in a timely manner. An immediate effort should be undertaken to establish quickly any necessary standards and criteria, including the nature of any required assurance or evidentiary showings, for the decisions required under this section. Further, such procedures shall specify that if he intends to prepare a Nuclear Proliferation Assessment Statement, the Director shall so declare in his response to the Department of Energy. If the Director declares that he intends to prepare such a Statement, he shall do so within sixty days of his receipt of a copy of the proposed subsequent arrangement (during which time the Secretary of Energy may not enter into the subsequent arrangement), unless pursuant to the Director's request, the President waives the sixty-day requirement and notifies the Committee on International Relations of the House of Representatives and the Committee on Foreign Relations of the Senate of such waiver and the justification therefor. The processing of any subsequent arrangement proposed and filed as of the date of enactment of this section shall not be delayed pending the development and establishment of procedures to implement the requirements of this section.

"d. Nothing in this section is intended to prohibit, permanently or unconditionally, the reprocessing of spent fuel owned by a foreign nation which fuel has been supplied by the United States, to preclude the United States from full participation in the International Nuclear Fuel Cycle Evaluation provided for in section 105 of the Nuclear Non-Proliferation Act of 1978; to in any way limit the presentation or consideration in that evaluation of any nuclear fuel cycle by the United States or any other participation; nor the prejudice open and objective consideration of the results of the evaluation.

"e. Notwithstanding subsection 402(d) of the Department of Energy Organization Act (Public Law 95-91), the Secretary of Energy, and not the Federal Energy Regulatory Commission, shall have sole jurisdiction within the Department of Energy over any matter arising from any function of the Secretary of Energy in this section.

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[69] Such procedures were issued on June 1, 1978. For text, see vol. III, page 646.

"f. (1) With regard to any subsequent arrangement under subsection a. (2)(E) (for the storage or disposition of irradiated fuel elements), where such arrangement involves a direct or indirect commitment of the United States for the storage or other disposition, interim or permanent, of any foreign spent nuclear fuel in the United States, the Secretary of Energy may not enter into any such subsequent arrangement, unless:

"(A)(i) Such commitment of the United States has been submitted to the Congress for a period of sixty days of continuous session (as defined in subsection 130 g. of this Act) and has been referred to the Committee on International Relations of the House of Representatives and the Committee on Foreign Relations of the Senate, but any such commitment shall not become effective if during such sixty-day period the Congress adopts a concurrent resolution stating in substance that it does not favor the commitment, any such commitment to be considered pursuant to the procedures set forth in section 130 of this Act for the consideration of Presidential submissions; or (ii) if the President has submitted a detailed generic plan for such disposition or storage in the United States to the Congress for a period of sixty days of continuous session (as defined in subsection 130 g. of this Act), which plan has been referred to the Committee on International Relations of the House of Representatives and the Committee on Foreign Relations of the Senate and has not been disapproved during such sixty-day period by the adoption of a concurrent resolution stating in substance that Congress does not favor the plan; and the commitment is subject to the terms of an effective plan. Any such plan shall be considered pursuant to the procedures set forth in section 130 of this Act for the consideration of Presidential submissions;

"(B) The Secretary of Energy has complied with subsection a.; and

"(C) The Secretary of Energy has complied, or in the arrangement will comply with all other statutory requirements of this Act, under sections 54 and 55 and any other applicable sections, and any other requirements of law.

"(2) Subsection (1) shall not apply to the storage or other disposition in the United States of limited quantities of foreign spent nuclear fuel if the President determines that (A) a commitment under section 54 or 55 of this Act of the United States for storage or other disposition of such limited quantities in the United States is required by an emergency situation, (B) it is in the national interest to take such immediate action, and (C) he notifies the Committees on International Relations and Science and Technology of the House of Representatives and the Committees on Foreign Relations and Energy and Natural Resources of the Senate of the determination and action, with a detailed explanation and justification thereof, as soon as possible.

"(3) Any plan submitted by the President under subsection f. (1) shall include a detailed discussion, with detailed information, and any supporting documentation thereof, relating to policy objectives, technical description, geographic information, cost data and justifications, legal and regulatory considerations, environmental impact information and any related international *agreements*, arrangements or understandings.

"(4) For the purposes of this subsection, the term 'foreign spent nuclear fuel' shall include any nuclear fuel irradiated in any nuclear power reactor located outside of the United States and operated by any foreign legal entity, government or nongovernment, regardless of the legal ownership or other control of the fuel or the reactor and regardless of the origin or licensing of the fuel or reactor, but not including fuel irradiated in a research reactor.

"CHAPTER 12. CONTROL OF INFORMATION

"**Sec. 141. Policy.**—It shall be the policy of the Commission to control the dissemination and declassification of Restricted Data in such a manner as to assure the common defense and security. Consistent with such policy, the Commission shall be guided by the following principles:

"a. Until effective and enforceable international safeguards against the use of atomic energy for destructive purposes have been established by an international arrangement, there shall be no exchange of Restricted Data with other nations except as authorized by section 144; and

"b. The dissemination of scientific and technical information relating to atomic energy should be permitted and encouraged so as to provide that free interchange of ideas and criticism which is essential to scientific and industrial progress and public understanding and to enlarge the fund of technical information.

"**Sec. 142. Classification and Declassification of Restricted Data.**—

"a. The Commission shall from time to time determine the data, within the definition of Restricted Data, which can be published without undue risk to the common defense and security and shall thereupon cause such data to be declassified and removed from the category of Restricted Data.

"b. The Commission shall maintain a continuous review of Restricted Data and of any Classification Guides issued for the guidance of those in the atomic energy program with respect to the areas of Restricted Data which have been declassified in order to determine which information may be declassified and removed from the category of Restricted Data without undue risk to the common defense and security.

"c. In the case of Restricted Data which the Commission and the Department of Defense jointly determine to relate primarily to the military utilization of atomic weapons, the determination that such data may be published without constituting an unreasonable risk to the common defense and security shall be made by the Commission and the Department of Defense jointly, and if the Commission and the Department of Defense do not agree, the determination shall be made by the President.

"d. The Commission shall remove from the Restricted Data category such data as the Commission and the Department of Defense jointly determine relates primarily to the military utilization of atomic weapons and which the Commission and Department of Defense jointly determine can be adequately safeguarded as defense information: *Provided, however,* That no such data so removed from the Restricted Data category shall be transmitted or otherwise made available to any nation or regional defense organization, while such data remains defense information, except pursuant to an agreement for cooperation entered into in accordance with subsection 144 b.

"e. The Commission shall remove from the Restricted Data category such information concerning the atomic energy programs of other nations as the Commission and the Director of Central Intelligence jointly determine to be necessary to carry out the provisions of section 102(d) of the National Security Act of 1947, as amended, and can be adequately safeguarded as defense information.

"**Sec. 143. Department of Defense Participation.**—The Commission may authorize any of its employees, or employees of any contractor, prospective contractor, licensee or prospective licensee of the Commission or any other person authorized access to Restricted Data by the Commission under subsection 145 b. and 145 c.[80] to permit any employee of an agency of the Department of Defense or of its contractors, or any member of the Armed Forces to have access to Restricted Data required in the performance of his duties and so certified by the head of the appropriate agency of the Department of Defense or his designee: *Provided, however,* That the head of the appropriate agency of the Department of Defense or his designee has determined, in accordance with the established personnel security procedures and standards of such agency, that permitting the member or employee to have access to such Restricted Data will not endanger the common defense and security: *And provided further,* That the Secretary of Defense finds that the established personnel and other security procedures and standards of such agency are adequate and in reasonable conformity to the standards established by the Commission under section 145.

"**Sec. 144. International Cooperation.**—

"a. The President may authorize the Commission to cooperate with another nation and to communicate to that nation Restricted Data on—

"(1) refining, purification, and subsequent treatment of source material;

"(2) civilian reactor development;

"(3) production of special nuclear material;

"(4) health and safety;

"(5) industrial and other applications of atomic energy for peaceful purposes; and

"(6) research and development relating to the foregoing:

Provided, however, That no such cooperation shall involve the communication of Restricted Data relating to the design or fabrication of atomic weapons: *And provided further,* That the cooperation is undertaken pursuant to an agreement for cooperation entered into in accordance with section 123, or is undertaken pursuant to an agreement existing on the effective date of this act.[61]

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[80] Public Law 84-1006 (70 Stat. 1069) (1956), sec. 14, added the words "or any other person authorized access to Restricted Data by the Commission under subsection 145 b." Public Law 87-206 (75 Stat. 475) (1961), sec. 5, deleted the words "subsection 145 b.," and substituted in lieu thereof the words, "subsections 145 b. and 145 c.".

"b.[62] The President may authorize the Department of Defense, with the assistance of the Commission, to cooperate with another nation or with a regional defense organization to which the United States is a party, and to communicate to that nation or organization such Restricted Data (including design information) as is necessary to—

"(1) the development of defense plans;

"(2) the training of personnel in the employment of and defense against atomic weapons and other military applications of atomic energy;

"(3) the evaluation of the capabilities of potential enemies in the employment of atomic weapons and other military applications of atomic energy; and

"(4) the development of compatible delivery systems for atomic weapons;

whenever the President determines that the proposed cooperation and the proposed communication of the Restricted Data will promote and will not constitute an unreasonable risk to the common defense and security, while such other nation or organization is participating with the United States pursuant to an international arrangement by substantial and material contributions to the mutual defense and security: *Provided, however*, That the cooperation is undertaken pursuant to an agreement entered into in accordance with section 123.

"c.[63] In addition to the cooperation authorized in subsections 144 a. and 144 b., the President may authorize the Commission, with the assistance of the Department of Defense, to cooperate with another nation and—

"(1) to exchange with that nation Restricted Data concerning atomic weapons: *Provided*, That communication of such Restricted Data to that nation is necessary to improve its atomic weapon design, development, or fabrication capability and provided that nation has made substantial progress in the development of atomic weapons; and

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[61] Public Law 85-479 (72 Stat. 276) (1958), sec. 5, amended subsec. a of sec. 144 by inserting the word "civilian" before the words "reactor development" in clause (2) thereof.

[62] Public Law 85-479 (72 Stat. 276) (1958), sec. 6, amended sec. 144 by substituting a new subsec. b. Before amendment subsec. b read as follows:

"b. The President may authorize the Department of Defense, with the assistance of the Commission, to cooperate with another nation or with a regional defense organization to which the United States is a party, and to communicate to that nation or organization such Restricted Data as is necessary to—

"(1) the development of defense plans;

"(2) the training of personnel in the employment of and defense against atomic weapons; and

"(3) the evaluation of the capabilities of potential enemies in the employment of atomic weapons.

"While such other nation or organization is participating with the United States pursuant to an international arrangement by substantial and material contributions to the mutual defense and security: *Provided, however*, That no such cooperation shall involve communication of Restricted Data relating to the design or fabrication of atomic weapons except with regard to external characteristics, including size, weight, and shape, yields and effects, and systems employed in the delivery or use thereof but not including any data in these categories unless in the joint judgment of the Commission and the Department of Defense such data will not reveal important information concerning the design or fabrication of the nuclear components of an atomic weapon: *And provided further*, That the cooperation is undertaken pursuant to an agreement entered into in accordance with section 123."

[63] Public Law 85-479 (72 Stat. 276) (1958), sec. 7, amended sec. 144 by adding subsecs. c and d.

"(2) to communicate or exchange with that nation Restricted Data concerning research, development, or design, or military reactors,

whenever the President determines that the proposed cooperation and the communication of the proposed Restricted Data will promote and will not constitute an unreasonable risk to the common defense and security, while such other nation is participating with the United States pursuant to an international arrangement by substantial and material contributions to the mutual defense and security: *Provided, however,* That the cooperation is undertaken pursuant to an agreement entered into in accordance with section 123.

"d.[83] The President may authorize an agency of the United States to communicate in accordance with the terms and conditions of an agreement for cooperation arranged pursuant to subsection 144 a., b., or c., such Restricted Data as is determined to be transmissible under the agreement for cooperation involved.

"Sec. 145. Restrictions.—

"a. No arrangement shall be made under section 31, no contract shall be made or continued in effect under section 41, and no license shall be issued under section 103 or 104, unless the person with whom such arrangement is made, the contractor or prospective contractor, or the prospective licensee agrees in writing not to permit any individual to have access to Restricted Data until the Civil Service Commission shall have made an investigation and report to the Commission on the character, associations, and loyalty of such individual, and the Commission shall have determined that permitting such person to have access to Restricted Data will not endanger the common defense and security.

"b. Except as authorized by the Commission or the General Manager upon a determination by the Commission or General Manager that such action is clearly consistent with the national interest, no individual shall be employed by the Commission nor shall the Commission permit any individual to have access to Restricted Data until the Civil Service Commission shall have made an investigation and report to the Commission on the character, associations and loyalty of such individual, and the Commission shall have determined that permitting such person to have access to Restricted Data will not endanger the common defense and security.

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"Sec. 147.[84] Safeguards Information.—

"a. In addition to any other authority or requirement regarding protection from disclosure of information, and subject to subsection (b)(3) of section 552 of title 5 of the United States Code, the Commission shall prescribe such regulations, after notice and opportunity for public comment, or issue such orders, as necessary to prohibit the unauthorized disclosure of safeguards information which specifically identifies a licensee's or applicant's detailed—

"(1) control and accounting procedures or security measures (including security plans, procedures or equipment) for the physical protection of special nuclear material, by whomever possessed, whether in transit or at fixed sites, in quantities determined by the Commission to be significant to the public health and safety or the common defense and security;

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[84] Sec. 147 was added by sec. 207(a)(1) of Public Law 96-295 (94 Stat. 788).

"(2) security measures (including security plans, procedures and equipment) for the physical protection of source material or byproduct material, by whomever possessed, whether in transit or at fixed sites, in quantities determined by the Commission to be significant to the public health and safety or the common defense and security; or

"(3) security measures (including security plans, procedures, and equipment) for the physical protection of and the location of certain plant equipment vital to the safety of production or utilization facilities involving nuclear materials covered by paragraphs (1) and (2)

if the unauthorized disclosure of such information could reasonably be expected to have a significant adverse effect on the health and safety of the public or the common defense and security by significantly increasing the likelihood of theft, diversion, or sabotage of such material or such facility. The Commission shall exercise the authority of this subsection—

"(A) so as to apply the minimum restrictions needed to protect the health and safety of the public or the common defense and security, and

"(B) upon a determination that the unauthorized disclosure of such information could reasonably be expected to have a significant adverse effect on the health and safety of the public or the common defense and security by significantly increasing the likelihood of theft, diversion, or sabotage of such material or such facility.

Nothing in this Act shall authorize the Commission to prohibit the public disclosure of information pertaining to the routes and quantities of shipments of source material, by-product material, high level nuclear waste, or irradiated nuclear reactor fuel. Any person, whether or not a licensee of the Commission, who violates any regulation adopted under this section shall be subject to the civil monetary penalties of section 234 of this Act. Nothing in this section shall be construed to authorize the withholding of information from the duly authorized committees of the Congress.

"b. For the purposes of section 223 of this Act, any regulations or orders prescribed or issued by the Commission under this section shall also be deemed to be prescribed or issued under section 161 b. of this Act.

"c. Any determination by the Commission concerning the applicability of this section shall be subject to judicial review pursuant to subsection (a)(4)(B) of section 552 of title 5 of the United States Code.

"d. Upon prescribing or issuing any regulation or order under subsection a. of this section, the Commission shall submit to Congress a report that:

"(1) specifically identifies the type of information the Commission intends to protect from disclosure under the regulation or order;

"(2) specifically states the Commission's justification for determining that unauthorized disclosure of the information to be protected from disclosure under the regulation or order could reasonably be expected to have a significant adverse effect on the health and safety of the public or the common defense and security by significantly increasing the likelihood of theft, diversion, or sabotage of such material or such facility, as specified under subsection (a) of this section; and

"(3) provides justification, including proposed alternative regulations or orders, that the regulation or order applies only the minimum restrictions needed to protect the health and safety of the public or the common defense and security.

"e. In addition to the reports required under subsection d. of this section, the Commission shall submit to Congress on a quarterly basis a report detailing the Commission's application during that period of every regulation or order prescribed or issued under this section. In particular, the report shall:

"(1) identify any information protected from disclosure pursuant to such regulation or order;

"(2) specifically state the Commission's justification for determining that unauthorized disclosure of the information protected from disclosure under such regulation or order could reasonably be expected to have a significant adverse effect on the health and safety of the public or the common defense and security by significantly increasing the likelihood of theft, diversion or sabotage of such material, or such facility, as specified under subsection a. of this section; and

"(3) provide justification that the Commission has applied such regulation or order so as to protect from disclosure only the minimum amount of information necessary to protect the health and safety of the public or the common defense and security.

"Sec. 148.[88] Prohibition Against the Dissemination of Certain Unclassified Information.—

"a. (1) In addition to any other authority or requirement regarding protection from dissemination of information, and subject to section 552(b)(3) of title 5, United States Code, the Secretary of Energy (hereinafter in this section referred to as the 'Secretary'), with respect to atomic energy defense programs,[89] shall prescribe such regulations, after notice and opportunity for public comment thereon, or issue such orders as may be necessary to prohibit the unauthorized dissemination of unclassified information pertaining to—

"(A) the design of production facilities or utilization facilities;

"(B) security measures (including security plans, procedures, and equipment) for the physical protection of (i) production or utilization facilities, (ii) nuclear material contained in such facilities, or (iii) nuclear material in transit; or

"(C) the design, manufacture, or utilization of any atomic weapon or component if the design, manufacture, or utilization of such weapon or component was contained in any information declassified or removed from the Restricted Data category by the Secretary (or the head of the predecessor agency of the Department of Energy) pursuant to section 142.

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[88] Sec. 210(a)(1) of Public Law 97–90 (95 Stat. 1169) added sec. 148.

[89] Sec. 17(a) of Public Law 97–415 (96 Stat. 2076) added the words ", with respect to atomic energy defense programs,".

"(2) The Secretary may prescribe regulations or issue orders under paragraph (1) to prohibit the dissemination of any information described in such paragraph only if and to the extent that the Secretary determines that the unauthorized dissemination of such information could reasonably be expected to have a significant adverse effect on the health and safety of the public or the common defense and security by significantly increasing the likelihood of (A) illegal production of nuclear weapons, or (B) theft, diversion, or sabotage of nuclear materials, equipment, or facilities.

"(3) In making a determination under paragraph (2), the Secretary may consider what the likelihood of an illegal production, theft, diversion, or sabotage referred to in such paragraph would be if the information proposed to be prohibited from dissemination under this section were at no time available for dissemination.

"(4) The Secretary shall exercise his authority under this subsection to prohibit the dissemination of any information described in subsection a.(1)—

"(A) so as to apply the minimum restrictions needed to protect the health and safety of the public or the common defense and security; and

"(B) upon a determination that the unauthorized dissemination of such information could reasonably be expected to result in a significant adverse effect on the health and safety of the public or the common defense and security by significantly increasing the likelihood of (i) illegal production of nuclear weapons, or (ii) theft, diversion, or sabotage of nuclear materials, equipment, or facilities.

"(5) Nothing in this section shall be construed to authorize the Secretary to authorize the withholding of information from the appropriate committees of the Congress.

"b. (1) Any person who violates any regulation or order of the Secretary issued under this section with respect to the unauthorized dissemination of information shall be subject to a civil penalty, to be imposed by the Secretary, of not to exceed $100,000 for each such violation. The Secretary may compromise, mitigate, or remit any penalty imposed under this subsection.

"(2) The provisions of subsections b. and c. of section 234 of this Act shall be applicable with respect to the imposition of civil penalties by the Secretary under this section in the same manner that such provisions are applicable to the imposition of civil penalties by the Commission under subsection a. of such section.

"c. For the purposes of section 223 of this Act, any regulation prescribed or order issued by the Secretary under this section shall also be deemed to be prescribed or issued under section 161 b. of this Act."

"d.[67] Any determination by the Secretary concerning the applicability of this section shall be subject to judicial review pursuant to section 552(a)(4)(B) of title 5, United States Code.

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[67] Sec. 17(b) of Public Law 97-415 (96 Stat. 2076) added subsecs. d and e.

"e.[67] The Secretary shall prepare on a quarterly basis a report to be made available upon the request of any interested person, detailing the Secretary's application during that period of each regulation or order prescribed or issued under this section. In particular, such report shall—

"(1) identify any information protected from disclosure pursuant to such regulation or order;

"(2) specifically state the Secretary's justification for determining that unauthorized dissemination of the information protected from disclosure under such regulation or order could reasonably be expected to have a significant adverse effect on the health and safety of the public or the common defense and security by significantly increasing the likelihood of illegal production of nuclear weapons, or theft, diversion, or sabotage of nuclear materials, equipment, or facilities, as specified under subsection a.; and

"(3) provide justification that the Secretary has applied such regulation or order so as to protect from disclosure only the minimum amount of information necessary to protect the health and safety of the public or the common defense and security."

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"CHAPTER 17. JOINT COMMITTEE ON ATOMIC ENERGY

[REPEALED—1977] [68]

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"CHAPTER 19. MISCELLANEOUS

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"**Sec. 251. Report to Congress.**—The Commission shall submit to the Congress, in January [69] of each year, a report concerning the activities of the Commission. The Commission shall include in such report, and shall at such other times as it deems desirable submit to the Congress, such recommendations for additional legislation as the Commission deems necessary or desirable.

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"CHAPTER 20.[70] JOINT COMMITTEE ON ATOMIC ENERGY ABOLISHED; FUNCTIONS AND RESPONSIBILITIES REASSIGNED

"**Sec. 301. Joint Committee on Atomic Energy Abolished.**—

"a. The Joint Committee on Atomic Energy is abolished.

"b. Any reference in any rule, resolution, or order of the Senate or the House of Representatives or in any law, regulation, or Executive order to the Joint Committee on Atomic Energy shall, on and after the date of enactment of this section, be considered as referring to the committees of the Senate and the House of Representatives which, under the rules of the Senate and the House, have jurisdiction over the subject matter of such reference.

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[68] Sec. 303(a) of this act, as added by Public Law 95-110, repealed ch. 17. For matters regarding the reassignment of functions and responsibilities of the Joint Committee, see ch. 20.

[69] Public Law 86-43 (73 Stat. 73) (1959), amended sec. 251 by deleting the words "and July" after the word "January".

[70] Chapter 20 was added by Public Law 95-110 (91 Stat. 884).

"c. All records, data, charts, and files of the Joint Committee on Atomic Energy are transferred to the committees of the Senate and House of Representatives which, under the rules of the Senate and the House, have jurisdiction over the subject matters to which such records, data, charts, and files relate. In the event that any record, data, chart, or file shall be within the jurisdiction of more than one committee, duplicate copies shall be provided upon request.

"Sec. 302. Transfers of Certain Functions of the Joint Committee on Atomic Energy and Conforming Amendments to Certain Other Laws.—

"a. Effective on the date of enactment of this section, chapter 17 of this Act is repealed.

"b. Section 103 of the Atomic Energy Community Act of 1955, as amended, is repealed.

"c. Section 3 of the Congressional Budget and Impoundment Control Act of 1974 is amended by—

"(1) striking the subsection designation '(a)'; and

"(2) repealing subsection (b).

"d. Section 252(a)(3) of the Legislative Reorganization Act of 1970 is repealed.

"Sec. 303. Information and Assistance to Congressional Committees.—

"a. The Secretary of Energy and the Nuclear Regulatory Commission shall keep the committees of the Senate and the House of Representatives which under the rules of the Senate and the House, have jurisdiction over the functions of the Secretary or the Commission, fully and currently informed with respect to the activities of the Secretary and the Commission.

"b. The Department of Defense and Department of State shall keep the committees of the Senate and the House of Representatives which under the rules of the Senate and the House, have jurisdiction over national security considerations of nuclear energy, fully and currently informed with respect to such matters within the Department of Defense and Department of State relating to national security considerations of nuclear technology which are within the jurisdiction of such committees.

"c. Any Government agency shall furnish any information requested by the committees of the Senate and the House of Representatives which, under the rules of the Senate and the House, have jurisdiction over the development, utilization, or application of nuclear energy, with respect to the activities or responsibilities of such agency in the field of nuclear energy which are within the jurisdiction of such committees.

"d. The committees of the Senate and the House of Representatives which, under the rules of the Senate and the House, have jurisdiction over the development, utilization, or application of nuclear energy, are authorized to utilize the services, information, facilities, and personnel of any Government agency which has activities or responsibilities in the field of nuclear energy which are within the jurisdiction of such committees: *Provided, however,* That any utilization of personnel by such committees shall be on a reimbursable basis and shall require, with respect to committees of the Senate, the prior written consent of the Committee on Rules and Administration, and with respect to committees of the House of Representatives, the prior written consent of the Committee on House Administration.".

e. International Atomic Energy Agency Participation Act of 1957, as amended

Partial text of Public Law 85–177 [H.R. 8992], 22 U.S.C. 2021–2026, 71 Stat. 453, approved August 28, 1957; as amended by Public Law 85–795, 72 Stat. 959, approved August 28, 1958; Public Law 89–348, 79 Stat. 1310, approved November 8, 1965; and by Public Law 96–465 [H.R. 6790], 94 Stat. 2071 at 2161, approved October 17, 1980

AN ACT To provide for the appointment of representatives of the United States in the organs of the International Atomic Energy Agency, and to make other provisions with respect to the participation of the United States in that Agency, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the "International Atomic Energy Agency Participation Act of 1957".

Sec. 2. (a) The President, by and with the advice and consent of the Senate, shall appoint a representative and a deputy representative of the United States to the International Atomic Energy Agency (hereinafter referred to as the "Agency"), who shall hold office at the pleasure of the President. Such representative and deputy representative shall represent the United States on the Board of Governors of the Agency, may represent the United States at the General Conference, and may serve ex officio as United States representative on any organ of that Agency, and shall perform such other functions in connection with the participation of the United States in the Agency as the President may from time to time direct.

(b) The President, by and with the advice and consent of the Senate, may appoint or designate from time to time to attend a specified session or specified sessions of the General Conference of the Agency a representative of the United States and such number of alternates as he may determine consistent with the rules of procedure of the General Conference.

(c) The President may also appoint or designate from time to time such other persons as he may deem necessary to represent the United States in the organs of the Agency. The President may designate any officer of the United States Government, whose appointment is subject to confirmation by the Senate, to act, without additional compensation, for temporary periods as the representative of the United States on the Board of Governors or to the General Conference of the Agency in the absence or disability of the representative and deputy representative appointed under section 2(a) or in lieu of such representatives in connection with a specified subject matter.

(d) All persons appointed or designated in pursuance of authority contained in this section shall receive compensation at rates determined by the President upon the basis of duties to be performed but not in excess of rates authorized by sections 401, 402, and 403 of the Foreign Service Act of 1980 by chiefs of mission, members of the Senior Foreign Service, and Foreign Service officers occupying positions of equivalent importance, except that no Member of the Senate or House of Representatives or offficer of the United States who is designated under subsection (b) or subsection (c) of this section as a delegate or representative of the United States or as an alternate to attend any specified session or specified sessions of the General Conference shall be entitled to receive such compensation.[1] Any person who receives compensation pursuant to the provisions of this subsection may be granted allowances and benefits not to exceed those received under the Foreign Service Act of 1980 by chiefs of mission, members of the Senior Foreign Service and Foreign Service officers occupying positions of equivalent importance.[2]

Sec. 3. The participation of the United States in the International Atomic Energy Agency shall be consistent with and in furtherance of the purposes of the Agency set forth in its statute and the policy concerning the development, use, and control of atomic energy set forth in the Atomic Energy Act of 1954, as amended. [The President shall, from time to time as occasion may require, but not less than once each year, make reports to the Congress on the activities of the International Atomic Energy Agency and on the participation of the United States therein.] [3] In addition to any other requirements of law, the Department of State and the Atomic Energy Commission shall keep the Joint Committee on Atomic Energy, the House Committee on Foreign Affairs, and the Senate Committee on Foreign Relations, as appropriate, currently informed with respect to the activities of the Agency and the participation of the United States therein.

Sec. 4. The representatives provided for in section 2 hereof, when representing the United States in the organs of the Agency, shall, at all times, act in accordance with the instructions of the President, and such representatives shall, in accordance with such instructions, cast any and all votes under the statute of the International Atomic Energy Agency.

Sec. 5. There is hereby authorized to be appropriated annually to the Department of State, out of any money in the Treasury not otherwise appropriated, such sums as may be necessary for the payment by the United States of its share of the expenses of the International Atomic Energy Agency as apportioned by the Agency in accordance with paragraph (D) of article XIV of the statute of the Agency, and for all necessary salaries and expenses of the representatives provided for in section 2 hereof and of their appropriate staffs, including personal services without regard to the civil service laws and the Classification Act of 1949, as amended; travel expenses without regard to the Standardized Government Travel Regulations, as amended, the Travel Expense Act of 1949, as amended, and section 10 of the Act of March 3, 1933, as amended; salaries as authorized by the Foreign Service Act of 1980,[4] or as authorized by the Atomic Energy Act of 1954, as amended, and expenses and allowances of personnel and dependents as authorized by the Foreign Service Act of 1980; [4] services as authorized by sec. 15 of the Act of Aug. 2, 1946 (5 U.S.C. 55a); [5] translating and other services, by contract; hire of passenger motor vehicles and other local transportation; printing and binding without regard to section 11 of the Act of March 1, 1919 (44 U.S.C. 111); official functions and courtesies; such sums as may be necessary to defray the expenses of United States participation in the Preparatory Commission for the Agency, established pursuant to annex I of the statute of the Agency; and such other expenses as may be authorized by the Secretary of State.

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[1] References in this subsection to sections of the Foreign Service Act of 1980 and to the Senior Foreign Service were inserted by sec. 2206(a)(7) of Public Law 94–465 (94 Stat. 2161), effective Feb. 15, 1981. These replaced a reference to secs. 411 and 412 of the Foreign Service Act of 1946.

[2] The references to the Foreign Service Act of 1980 and to the Senior Foreign Service were inserted by sec. 2206(a)(7) of Public Law 96–465 (94 Stat. 2161), effective Feb. 15, 1981.

[3] Public Law 89–348 (79 Stat. 1310, sec. 1(20)), amended Public Law 85–177 by repealing the requirement of a report to the Congress by the President not less than once each year on the activities of the Intrernational Atomic Energy Agency and on the participation of the United States therein.

Sec. 6. (a) [6] Notwithstanding any other provision of law, Executive order or regulation, a Federal employee who, with the approval of the Federal agency, or the head of the department by which he is employed, leaves his position to enter the employ of the Agency shall not be considered for the purposes of the Civil Service Retirement Act, as amended, and the Federal Employees' Group Life Insurance Act of 1954, as amended, as separated from his Federal position during such employment with the Agency but not to extend beyond the first three consecutive years of his entering the employ of the Agency: *Provided*, (1) That he shall pay to the Civil Service Commission [7] within ninety days from the date he is separated without prejudice from the Agency all necessary deductions and agency contributions for coverage under the Civil Service Retirement Act for the period of his employment by the Agency, and (2) That all deductions and agency contributions necessary for continued coverage under the Federal Employees' Group Life Insurance Act of 1954, as amended, shall be made during the term of his employment with the International Atomic Energy Agency. If such employee, within three years from the date of his employment with the Agency, and within ninety days from the date he is separated without prejudice from the Agency, applies to be restored to his Federal position, he shall within thirty days of such application be restored to such position or to a position of like seniority, status and pay.

(b) Notwithstanding any other provision of law, Executive order or regulation, any Presidential appointee or elected officer who leaves his position to enter, or who within ninety days after the termination of his position enters, the employ of the Agency, shall be entitled to the coverage and benefits of the Civil Service Retirement Act, as amended, and the Federal Employees' Group Life Insurance Act of 1954, as amended, but not beyond the earlier of either the termination of his employment with the Agency or the expiration of three years from the date he entered employment with the Agency: *Provided*, (1) That he shall pay to the Civil Service Commission [7] within ninety days from the date he is separated without prejudice from the Agency all necessary deductions and agency contributions for coverage under the Civil Service Retirement Act for the period of his employment by the agency and (2) That all deductions and agency contributions necessary for continued coverage under the Federal Employees' Group Life Insurance Act of 1954, as amended, shall be made during the term of his employment with the Agency.

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[4] Reference to the Foreign Service Act of 1980 was inserted in lieu of a reference to the Foreign Service Act of 1946 by sec. 2206(a)(7) of Public Law 96–465 (94 Stat. 2162), effective Feb. 15, 1981.

[5] Public Law 89–554 (80 Stat. 416) codified sec. 15 of the Act of Aug. 2, 1946, as 5 U.S.C. 3109.

[6] Sec. 7 of Public Law 85–795 (72 Stat. 959), approved Aug. 28, 1958, repealed sec. 6(a), "except that it shall be considered to remain in effect with respect to any employee subject thereto who is serving as an employee of the International Atomic Energy Agency on the date of enactment of this Act and who does not make the election referred to in sec. 6 and for the purposes of any rights and benefits vested thereunder prior to such date."

[7] The Office of Personnel Management was substituted for the Civil Service Commission pursuant to sec. 102 of Reorganization Plan No. 2 of 1978.

(c) The President is authorized to prescribe such regulations as may be necessary to carry out the provisions of this section and to protect the retirement, insurance and such other civil service rights and privileges as the President may find appropriate.

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Sec. 8. In the event of an amendment to the Statute of the Agency being adopted in accordance with article XVIII–C of the Statute to which the Senate by formal vote shall refuse its advice and consent, upon notification by the Senate to the President of such refusal to advise and consent, all further authority under sections 2, 3, 4, and 5 of this Act, as amended, shall terminate: *Provided, however*, That the Secretary of State, under such regulations as the President shall promulgate, shall have the necessary authority to complete the prompt and orderly settlement of obligations and commitments to the Agency already incurred and pay salaries, allowances, travel expenses, and other expenses required for a prompt and orderly termination of United States participation in the Agency: *And provided further*, That the representative and the deputy representative of the United States to the Agency, and such other officers or employees representing the United States in the Agency, under such regulations as the President shall promulgate, shall retain their authority under this Act for such time as may be necessary to complete the settlement of matters arising out of the United States participation in the Agency.

EURATOM Cooperation Act of 1958, as amended

Public Law 85-846 [S. 4273], 72 Stat. 1084, 42 U.S.C. 2291-2296, approved August 28, 1958; as amended by Public Law 87-206, 75 Stat. 479, approved September 6, 1961; Public Law 88-394, 78 Stat. 376, approved August 1, 1964; Public Law 90-190, 81 Stat. 578, approved December 14, 1967; and by Public Law 93-88, 87 Stat. 296, approved August 14, 1973

AN ACT To provide for cooperation with the European Atomic Energy Community.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the "EURATOM Cooperation Act of 1958".

Sec. 2. As used in this Act—

(a) "The Community" means the European Atomic Energy Community (EURATOM).

(b) The "Commission" means the Atomic Energy Commission, as established by the Atomic Energy Act of 1954, as amended.

(c) "Joint program" means the cooperative program established by the Community and the United States and carried out in accordance with the provisions of an agreement for cooperation entered into pursuant to the provisions of section 123 of the Atomic Energy Act of 1954, as amended, to bring into operation in the territory of the members of the Community powerplants using nuclear reactors of types selected by the Commission and the Community, having as a goal a total installed capacity of approximately one million kilowatts of electricity by December 31, 1963, except that two reactors may be selected to be in operation by December 31, 1965.

(d) All other terms used in this Act shall have the same meaning as terms described in section 11 of the Atomic Energy Act of 1954, as amended.

Sec. 3. There is hereby authorized to be appropriated to the Commission, in accordance with the provisions of section 261(a)(2) of the Atomic Energy Act of 1954, as amended, the sum of $3,000,000 [1] as an initial authorization for fiscal year 1959 for use in a cooperative program of research and development in connection with the types of reactors selected by the Commission and the Community under the joint program. The Commission may enter into contracts for such periods as it deems necessary, but in no event to exceed five years, for the purpose of conducting the research and development program authorized by this section: *Provided,* That the Community authorizes an equivalent amount for use in the cooperative program of research and development.

Sec. 4. The Commission is authorized, within limits of amounts which may hereafter be authorized to be appropriated in accordance with the provisions of section 261(a)(2) of the Atomic Energy Act of 1954, as amended, to make guarantee contracts which shall in the aggregate not exceed a total contingent liability of $90,000,000 designed to assure that the charges to an operator of a reactor constructed under the joint program for fabricating, processing, and transporting fuel will be no greater than would result under the fuel fabricating and fuel life guarantees which the Commission shall establish for such reactor. Within the limits of such amounts, the Commission is authorized to make contracts under this section, without regard to the provisions of sections 3679 and 3709 of the Revised Statutes, as amended, for such period of time as it determines to be necessary: *Provided, however,* That no such contracts may extend for a period longer than that necessary to cover fuel loaded into a reactor constructed under the joint program during the first ten years of the reactor operation or prior to December 31, 1973 (or December 31, 1975, for not more than two reactors selected under section 2(c)), whichever is earlier. In establishing criteria for the selection of projects and in entering into such guarantee contracts, the Commission shall be guided by, but not limited to, the following principles:

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[1] Public Law 86-50 (sec. 109), Public Law 87-701 (sec. 109), Public Law 88-72 (sec. 103), Public Law 88-332 (sec. 101(a)), and Public Law 89-32 (sec. 101), authorized appropriation of an additional $7,000,000, $5,000,000, $7,500,000, $3,000,000, and $3,000,000, respectively.

(a) The Commission shall encourage a strong and competitive atomic equipment manufacturing industry in the United States designed to provide diversified sources of supply for reactor parts and reactor fuel elements under the joint program;

(b) The guarantee shall be consistent with the provisions of this Act and of Attachment A to the Memorandum of Understanding between the Government of the United States and the Community, signed in Brussels on May 29, 1958, and in Washington, District of Columbia, on June 12, 1958, and transmitted to Congress on June 23, 1958;

"(c) [2] The Commission shall establish and publish criteria for computing the maximum fuel element charge and minimum fuel element life to be guaranteed by the manufacturer as a basis for inviting and evaluating proposals.

"(d) The guarantee by the manufacturer shall be as favorable as any other guarantee offered by the manufacturer for any comparable fuel element within a reasonable time period; and

"(e) The Commission shall obtain a royalty-free, nonexclusive, irrevocable license for governmental purposes to any patents on inventions or discoveries made or conceived by the manufacturer in the course of development or fabrication of fuel elements during the period covered by the Commission's guarantee.

"Sec. 5.[3] Pursuant to the provisions of section 54 of the Atomic Energy Act of 1954, as amended, there is hereby authorized for sale or lease to the Community—

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[2] Public Law 87-206 (75 Stat. 475), amended sec. 4(c). Prior to amendment it read: "The commission shall establish and publish minimum levels of fuel element cost and life to be guaranteed by the manufacturer as a basis for inviting and evaluating proposals."

[3] Public Law 90-190 (81 Stat. 575), sec. 13, amended sec. 5 by substituting a new section. Before amendment. Sec. 5 read as follows:

"Sec. 5. Pursuant to the provisions of section 54 of the Atomic Energy Act of 1954, as amended, there is hereby authorized for sale or lease to the Community:

Seventy thousand kilograms of contained uranium 235

Five hundred kilograms of plutonium

an amount of contained uranium 235 which does not exceed that necessary to support the fuel cycle of power reactors located within the Community having a total installed capacity of thirty-five thousand megawatts of electric energy, together with twenty-five thousand kilograms of contained uranium 235 for other purposes; [4]

one thousand five hundred kilograms of plutonium; and thirty kilograms of uranium 233;

in accordance with the provisions of an agreement or agreements for cooperation between the Government of the United States and the Community entered into pursuant to the provisions of section 123 of the Atomic Energy Act of 1954, as amended: *Provided*, That the Government of the United States obtains the equivalent of a first lien of any such material sold to the Community for which payment is not made in full at the time of transfer. The Commission may enter into contracts to provide, after December 31, 1968, for the producing or enriching of all, or part of, the above-mentioned contained uranium 235 pursuant to the provisions of subsection 161 v. (B) of said Act, as amended in lieu of sale or lease thereof.

Sec. 6. (a) The Atomic Energy Commission is authorized to purchase or otherwise acquire from the Community special nuclear material or any interest therein from reactors constructed under the joint program in accordance with the terms of an agreement for cooperation entered into pursuant to the provisions of section 123 of the Atomic Energy Act of 1954, as amended: *Provided*, That neither plutonium nor uranium 233 nor any interest therein shall be acquired under this section in excess of the total quantities authorized by law. The Commission is hereby authorized to acquire from the Community pursuant to this section up to four thousand one hundred kilograms of plutonium for use only for peaceful purposes.

(b) Any contract made under the provisions of this section to acquire plutonium or any interest therein may be at such prices and for such period of time as the Commission may deem necessary: *Provided*, That with respect to plutonium produced in any reactor constructed under the joint program, no such contract shall be for a period greater than ten years of operation of such reactors or December 31, 1973 (or December 31, 1975, for not more than two reactors selected under section 2(c)), whichever is earlier: *And provided further*, That no such contract shall provide for compensation or the payment of a purchase price in excess of the Commission's established price in effect at the time of delivery to the Commission for such material as fuel in a nuclear reactor.

Thirty kilograms of uranium 233

In accordance with the provisions of an agreement or agreements for cooperation between the Government of the United States and the Community entered into pursuant to the provisions of section 123 of the Atomic Energy Act of 1954 as amended: *Provided*, That the Government of the United States obtains the equivalent of a first lien of any such material sold to the Community for which payment is not made in full at the time of transfer."

Sec. 5 had earlier been amended by Public Law 88-394 (78 Stat. 376), sec. 5, and by Public Law 87-206 (75 Stat. 475), sec. 19.

[4] Public Law 93-88 (87 Stat. 296), amended this paragraph. Previously, it read "two hundred fifteen thousand kilograms of contained uranium 235;".

(c) Any contract made under the provisions of this section to acquire uranium enriched in the isotope uranium 235 may be at such price and for such period of time as the Commission may deem necessary: *Provided*, That no such contract shall be for a period of time extending beyond the terminal date of the agreement for cooperation with the Community or provide for the acquisition of uranium enriched in the isotope U-235 in excess of the quantities of such material that have been distributed to the Community by the Commission less the quantity consumed in the nuclear reactors involved in the joint program: *And provided further*, That no such contract shall provide for compensation or the payment of a purchase price in excess of the Atomic Energy Commission's established charges for such material in effect at the time delivery is made to the Commission.

(d) Any contract made under this section for the purchase of special nuclear material or any interest therein may be made without regard to the provisions of section 3679 of the Revised Statutes, as amended.

(e) Any contract made under this section may be made without regard to section 3709 of the Revised Statutes, as amended, upon certification by the Commission that such action is necessary in the interest of the common defense and security, or upon a showing by the Commission that advertising is not reasonably practicable.

"Sec. 7. The Government of the United States of America shall not be liable for any damages or third party liability arising out of or resulting from the joint program: *Provided however*, That nothing in this section shall deprive any person of any rights under section 170 of the Atomic Energy Act of 1954, as amended. *And provided further*, That nothing in this section shall apply to arrangements made by the Commission under a research and development program authorized in section 3.[6] The Government of the United States shall take such steps as may be necessary, including appropriate disclaimer or indemnity arrangements, in order to carry out the provisions of this section.".

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[6] The proviso was added by Public Law 87-206 (75 Stat. 475).

THE FOREIGN ASSISTANCE ACT OF 1961, AS AMENDED (Selected Excerpts)

Sec. 620E[378] **Assistance to Pakistan.**—(a) The Congress recognizes that Soviet Forces occupying Afghanistan pose a security threat to Pakistan. The Congress also recognizes that an independent and democratic Pakistan with continued friendly ties with the United States is in the interest of both nations. The Congress finds that United States assistance will help Pakistan maintain its independence. Assistance to Pakistan is intended to benefit the people of Pakistan by helping them meet the burdens imposed by the presence of Soviet forces in Afghanistan and by promoting economic development. In authorizing assistance to Pakistan, it is the intent of Congress to promote the expeditious restoration of full civil liberties and representative government in Pakistan. The Congress further recognizes that it is in the mutual interest of Pakistan and the United States to avoid the profoundly destabilizing effects of the proliferation of nuclear explosive devices or the capacity to manufacture or otherwise acquire nuclear devices.

(b) The United States reaffirms the commitment made in its 1959 bilateral agreement with Pakistan relating to aggression from a Communist or Communist-dominated state.

(c) Security assistance for Pakistan shall be made available in order to assist Pakistan in dealing with the threat to its security posed by the Soviet presence in Afghanistan. The United States will take appropriate steps to ensure that defense articles provided by the United States to Pakistan are used for defensive purposes.

(d) The President may waive the prohibitions of section 669 of this Act at any time during the period beginning on the date of enactment of this section and ending on September 30, 1987, to provide assistance to Pakistan during that period if he determines that to do so is in the national interest of the United States.

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[378] 22 U.S.C. 2375. Sec. 620E was added by sec. 736 of the International Security and Development Cooperation Act of 1981 (Public Law 97-113; 95 Stat. 1561). The President exercised his authority under subsec. (d) on Feb. 11, 1982.

Sec. 669.[785] **Nuclear Enrichment Transfers.**—(a) Except as provided in subsection (b), no funds authorized to be appropriated by this Act or the Arms Export Control Act may be used for the purpose of providing economic assistance (including assistance under chapter 4 or part II), providing military[786] assistance or grant military education and training, providing assistance under chapter 6 of part II,[787] or extending military credits or making guarantees, to any country which, on or after the date of enactment of the International Security Assistance Act of 1977, delivers nuclear enrichment equipment, materials, or technology to any other country, or receives such equipment, materials, or technology from any other country, unless before such delivery—

(1) the supplying country and receiving country have reached agreement to place all such equipment, materials, or technology, upon delivery, under multilateral auspices and management when available; and

(2) the recipient country has entered into an agreement with the International Atomic Energy Agency to place all such equipment, materials, technology, and all nuclear fuel and facilities in such country under the safeguards system of such Agency.

(b)(1) Notwithstanding subsection (a) of this section, the President may furnish assistance which would otherwise be prohibited under such subsection if he determines and certifies in writing to the Speaker of the House of Representatives and the Committee on Foreign Relations of the Senate that—

(A) the termination of such assistance would have a serious adverse effect on vital United States interests; and

(B) he has received reliable assurances that the country in question will not acquire or develop nuclear weapons or assist other nations in doing so.

Such certification shall set forth the reasons supporting such determination in each particular case.[788]

(2)[789] (A) A certification under paragraph (1) of this subsection shall take effect on the date on which the certification is received by the Congress. However, if, within 30 calendar days after receiving this certification, the Congress adopts a concurrent resolution stating in substance that the Congress disapproves the furnishing of assistance pursuant to the certification, then upon the adoption of that resolution the certification shall cease to be effective and all deliveries of assistance furnished under the authority of that certification shall be suspended immediately.

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[785] 22 U.S.C. 2429. Sec. 669, as added by sec. 305 of Public Law 94–329, was amended and restated by sec. 12 of the International Security Assistance Act of 1977 (Public Law 95–92; 91 Stat. 620).

See also sec. 620E of this Act (page 162) which authorizes the President to waive the prohibitions contained in sec. 669 in order to provide assistance to Pakistan.

[786] Sec. 10(b)(4) of the International Security Assistance Act of 1978 (Public Law 95–384; 92 Stat. 735), added the parenthetical phrase and struck the words "or security supporting" which previously appeared at this point.

[787] The reference to ch. 6 of pt. II was added by sec. 12(c)(3) of the International Security Assistance Act of 1978 (Public Law 95–384; 92 Stat. 737).

[788] Sec. 735 of the International Security and Development Cooperation Act of 1981 (Public Law 97–113; 95 Stat. 1561) requires an annual report from the President beginning with fiscal year 1983 on the nuclear programs and related activities of any country for which a waiver of secs. 669 or 670 is in effect. See page 279 for the complete text of sec. 735.

[789] Par. (2) was amended and restated by sec. 737(b) of the International Security and Development Cooperation Act of 1981 (Public Law 97–113; 95 Stat. 1562). It formerly read as follows:

"(2) Any joint resolution which would terminate or restrict assistance described in subsection (a) with respect to a country to which the prohibition in such subsection applies shall, if introduced within thirty days after the transmittal of a certification under paragraph (1) of this subsection with respect to such country, be considered in the Senate in accordance with the provisions of section 601(b) of the International Security Assistance and Arms Export Control Act of 1976."

(B) Any concurrent resolution under this paragraph shall be considered in the Senate in accordance with the provisions of section 601(b) of the International Security Assistance and Arms Export Control Act of 1976.

(C) For the purpose of expediting the consideration and adoption of concurrent resolutions under this paragraph, a motion to proceed to the consideration of any such resolution after it has been reported by the appropriate committee shall be treated as highly privileged in the the House of Representatives.

Sec. 670.[illegible] **Nuclear Reprocessing Transfers, Transfers of Nuclear Explosive Devices, and Nuclear Detonations.**—(a)(1) Except as provided in paragraph (2) of this subsection, no funds authorized to be appropriated by this Act or the Arms Export Control Act may be used for the purpose of providing economic assistance (including assistance under chapter 4 of part II), providing military assistance or grant military education and training, providing assistance under chapter 6 of part II, or extending military credits or making guarantees, to any country which on or after the date of enactment of the International Security Assistance Act of 1977 delivers nuclear reprocessing equipment, materials, or technology to any other country or receives such equipment, materials, or technology from

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[illegible] 22 U.S.C. 2429a. Sec. 670, as added by sec. 12 of Public Law 95-92; 91 Stat. 620), was amended and restated by sec. 737(c) of the International Security and Development Cooperation Act of 1981 (Public Law 97-113; 95 Stat. 1562). It formerly read as follows:

"Sec. 670. Nuclear Reprocessing Transfers and Nuclear Detonations.—(a) Except as provided in subsection (b), no funds authorized to be appropriated by this Act or the Arms Export Control Act may be used for the purpose of providing economic assistance (including assistance under chapter 4 of part II) providing military assistance or grant military education and training, providing assistance under chapter 6 of part II or extending military credits or making guarantees, to any country which on or after the date of enactment of the International Security Assistance Act of 1977—

"(1) delivers nuclear reprocessing equipment, materials, or technology to any other country or receives such equipment, materials, or technology from any other country (except for the transfer of reprocessing technology associated with the investigation, under international evaluation programs in which the United States participates, of technologies which are alternative to pure plutonium reprocessing); or

"(2) is not a nuclear-weapon state as defined in article IX(3) of the Treaty on the Non-Proliferation of Nuclear Weapons and which detonates a nuclear explosive device.

"(b)(1) Notwithstanding subsection (a) of this section, the President may furnish assistance which would otherwise be prohibited under such subsection if he determines and certifies in writing to the Speaker of the House of Representative and the Committee on Foreign Relations of the Senate that the termination of such assistance would be seriously prejudicial to the achievement of United States nonproliferation objectives or otherwise jeopardize the common defense and security. The President shall transmit with such certification a statement setting forth the specific reasons therefor.

"(2) Any joint resolution which would terminate or restrict assistance described in subsection (a) with respect to a country to which the prohibition in such subsection applies shall, if introduced within thirty days after the transmittal of a certification under paragraph (1) of this subsection with respect to such country, be considered in the Senate in accordance with the provisions of section 601(b) of the International Security Assistance and Arms Export Control Act of 1976."

Sec. 737(a) of Public Law 97-113 also provides the following:

"Sec. 737. (a) The Congress finds that any transfer of a nuclear explosive device to a non-nuclear-weapon state or, in the case of a non-nuclear-weapon state, any receipt or detonation of a nuclear explosive device would cause grave damage to bilateral relations between the United States and that country."

any other country (except for the transfer of reprocessing technology associated with the investigation, under international evaluation programs in which the United States participates, or technologies which are alternatives to pure plutonium reprocessing).

(2) Notwithstanding paragraph (1) of this subsection, the President may furnish assistance which would otherwise be prohibited under that paragraph if he determines and certifies in writing to the Speaker of the House of Representatives and the Committee on Foreign Relations of the Senate that the termination of such assistance would be seriously prejudicial to the achievement of United States nonproliferation objectives or otherwise jeopardize the common defense and security. The President shall transmit with such certification a statement setting forth the specific reasons therefor.”[88]

(3)(A) A certification under paragraph (2) of this subsection shall take effect on the date on which the certification is received by the Congress. However, if, within 30 calendar days after receiving this certification, the Congress adopts a concurrent resolution stating in substance that the Congress disapproves the furnishing of assistance pursuant to the certification, then upon the adoption of that resolution the certification shall cease to be effective and all deliveries of assistance furnished under the authority of that certification shall be suspended immediately.

(B) Any concurrent resolution under this paragraph shall be considered in the Senate in accordance with the provisions of section 601(b) of the International Security Assistance and Arms Export Control Act of 1976.

(C) For the purpose of expediting the consideration and adoption of concurrent resolutions under this paragraph, a motion to proceed to the consideration of any such resolution after it has been reported by the appropriate committee shall be treated as highly privileged in the House of Representatives.

(b)(1) Except as provided in paragraphs (2) and (3) of this subsection, no funds authorized to be appropriated by this Act or the Arms Export Control Act may be used for the purpose of providing economic assistance (including assistance under chapter 4 of part II), providing military assistance or grant military education and training, providing assistance under chapter 6 of part II, or extending military credits or making guarantees, to any country which on or after the date of enactment of the International Security Assistance Act of 1977—

(A) transfers a nuclear explosive device to a non-nuclear-weapon state, or

(B) is a non-nuclear-weapon state and either—

(i) receives a nuclear explosive device, or

(ii) detonates a nuclear explosive device.

(2)(A) Notwithstanding paragraph (1) of this subsection, the President may, for a period of not more than 30 days of continuous session, furnish assistance which would otherwise be prohibited under paragraph (1) of this subsection if, before furnishing such assistance, the President transmits to the Speaker of the House of Representatives, and to the Chairman of the Committee on Foreign Relations of the Senate, a certification that he has determined that an immediate termination of assistance to that country would be detrimental to the national security of the United States. Not more than one such certification may be transmitted for a country with respect to the same detonation, transfer, or receipt of a nuclear explosive device.

(B) If the President transmits a certification to the Congress under subparagraph (A), a joint resolution which would permit the President to exercise the waiver authority of paragraph (3) of this subsection shall, if introduced in either House within 30 days of continuous session after the Congress receives this certification, be considered in the Senate and House of Representatives in accordance with subparagraphs (C) and (D) of this paragraph.

(C) Any joint resolution under this paragraph shall be considered in the Senate in accordance with the provisions of section 601(b) of the International Security Assistance and Arms Export Control Act of 1976.

(D) For the purpose of expediting the consideration and adoption of joint resolution under this paragraph, a motion to proceed to the consideration of such a joint resolution after it has been reported by the appropriate committee shall be treated as highly privileged in the House of Representatives.

(E) For purposes of this paragraph, the term "joint resolution" means a joint resolution the matter after the resolving clause of which is as follows: "That the Congress having received on ——— a certification by the President under section 670(b)(2) of the Foreign Assistance Act of 1961 with respect to   , the Congress hereby authorizes the President to exercise the waiver authority contained in section 670(b)(3) of that Act.", with the date of receipt of the certification inserted in the first blank and the name of the country inserted in the second blank.

(3) Notwithstanding paragraph (1) of this subsection, if the Congress enacts a joint resolution under paragraph (2) of this subsection, the President may furnish assistance which would otherwise be prohibited under paragraph (1) if he determines and certifies in writing to the Speaker of the House of Representatives and the Committee on Foreign Relations of the Senate that the termination of such assistance would be seriously prejudicial to the achievement of United States nonproliferation objectives or otherwise jeopardize the common defense and security. The President shall transmit with such certification a statement setting forth the specific reasons therefor.

(4) For purposes of this subsection, continuity of session is broken only by an adjournment of Congress sine die and the days on which either House is not in session because of an adjournment of more than three days to a day certain are excluded in the computation of any period of time in which Congress is in continuous session.

(5) As used in this subsection, the term "non-nuclear-weapon state" means any country which is not a nuclear-weapon state, as defined in article IX(3) of the Treaty on the Non-Proliferation of Nuclear Weapons.

Nuclear Non-Proliferation Act of 1978

Partial text of Public Law 95-242 [H.R. 8638], 92 Stat. 120, approved March 10, 1978

AN ACT To provide for more efficient and effective control over the proliferation of nuclear explosive capability.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the "Nuclear Non-Proliferation Act of 1978."

> NOTE.—Sections of this Act which have been omitted amend the Atomic Energy Act of 1954. See the appropriate sections of the 1954 Act beginning on page 509 for the text of these omitted sections.

STATEMENT OF POLICY

SEC. 2.[1] The Congress finds and declares that the proliferation of nuclear explosive devices or of the direct capability to manufacture or otherwise acquire such devices poses a grave threat to the security interests of the United States and to continued international progress toward world peace and development. Recent events emphasize the urgency of this threat and the imperative need to increase the effectiveness of international safeguards and controls on peaceful nuclear activities to prevent proliferation. Accordingly, it is the policy of the United States to—

(a) actively pursue through international initiatives mechanisms for fuel supply assurances and the establishment of more effective international controls over the transfer and use of nuclear materials and equipment and nuclear technology for peaceful purposes in order to prevent proliferation, including the establishment of common international sanctions;

(b) take such actions as are required to confirm the reliability of the United States in meeting its commitments to supply nuclear reactors and fuel to nations which adhere to effective non-proliferation policies by establishing procedures to facilitate the timely processing of requests for subsequent arrangements and export licenses;

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[1] 22 U.S.C. 3201.

(c) strongly encourage nations which have not ratified the Treaty on the Non-Proliferation of Nuclear Weapons to do so at the earliest possible date; [2] and

(d) cooperate with foreign nations in identifying and adapting suitable technologies for energy production and, in particular, to identify alternative options to nuclear power in aiding such nations to meet their energy needs, consistent with the economic and material resources of those nations and environmental protection.

STATEMENT OF PURPOSE

Sec. 3.[3] It is the purpose of this Act to promote the policies set forth above by—

(a) establishing a more effective framework for international cooperation to meet the energy needs of all nations and to ensure that the worldwide development of peaceful nuclear activities and the export by any nation of nuclear materials and equipment and nuclear technology intended for use in peaceful nuclear activities do not contribute to proliferation;

(b) authorizing the United States to take such actions as are required to ensure that it will act reliably in meeting its commitment to supply nuclear reactors and fuel to nations which adhere to effective non-proliferation policies;

(c) providing incentives to the other nations of the world to join in such international cooperative efforts and to ratify the Treaty; and

(d) ensuring effective controls by the United States over its exports of nuclear materials and equipment and of nuclear technology.

DEFINITIONS

Sec. 4.[4] (a) As used in this Act, the term—

(1) "Commission" means the Nuclear Regulatory Commission;

(2) "Director" means the Director of the Arms Control and Disarmament Agency;

(3) "IAEA" means International Atomic Energy Agency;

(4) "nuclear materials and equipment" means source material, special nuclear material, production facilities, utilization facilities, and components, items or substances determined to have significance for nuclear explosive purposes pursuant to subsection 109 b. of the 1954 Act;

(5) "physical security measures" means measures to reasonably ensure that source or special nuclear material will only be used for authorized purpose and to prevent theft and sabotage;

(6) "sensitive nuclear technology" means any information (including information incorporated in a production or utiliza-

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[2] This policy was again reiterated by Congress in sec. 507 of the International Development Cooperation Act of 1979 (Public Law 96-53; 93 Stat. 378). Such sec. 507 also called for a report from the Secretary of State by Nov. 1, 1979, on steps taken by the Department of State to encourage nations which are not parties to the treaty to become parties. See vol. I, page 282 for complete text of sec. 507.

[3] 22 U.S.C. 3202.

[4] 22 U.S.C. 3203.

tion facility or important component part thereof) which is not available to the public and which is important to the design, construction, fabrication, operation or maintenance of a uranium enrichment or nuclear fuel reprocessing facility or a facility for the production of heavy water, but shall not include Restricted Data controlled pursuant to chapter 12 of the 1954 Act;

(7) "1954 Act" means the Atomic Energy Act of 1954, as amended; and

(8) "the Treaty" means the Treaty on the Non-Proliferation of Nuclear Weapons.[5]

(b) All other terms used in this Act not defined in this section shall have the meanings ascribed to them by the 1954 Act, the Energy Reorganization Act of 1974, and the Treaty.

TITLE I—UNITED STATES INITIATIVES TO PROVIDE ADEQUATE NUCLEAR FUEL SUPPLY

POLICY

Sec. 101.[6] The United States, as a matter of national policy, shall take such actions and institute such measures as may be necessary and feasible to assure other nations and groups of nations that may seek to utilize the benefits of atomic energy for peaceful purposes that it will provide a reliable supply of nuclear fuel to those nations and groups of nations which adhere to policies designed to prevent proliferation. Such nuclear fuel shall be provided under agreements entered into pursuant to section 161 of the 1954 Act or as otherwise authorized by law. The United States shall ensure that it will have available the capacity on a long-term basis to enter into new fuel supply commitments consistent with its nonproliferation policies and domestic energy needs. The Commission shall, on a timely basis, authorize the export of nuclear materials and equipment when all the applicable statutory requirements are met.

URANIUM ENRICHMENT CAPACITY

Sec. 102.[7] The Secretary of Energy is directed to initate construction planning and design, construction, and operation activities for expansion of uranium enrichment capacity, as elsewhere provided by law. Further the Secretary as well as the Nuclear Regulatory Commission, the Secretary of State, and the Director of the Arms Control and Disarmament Agency are directed to establish and implement procedures which will ensure to the maximum extent feasible, consistent with this Act, orderly processing of subsequent arrangements and export licenses with minimum time delay.

REPORT

Sec. 103. The President shall promptly undertake a study to determine the need for additional United States enrichment capacity to meet domestic and foreign needs and to promote United States nonproliferation objectives abroad. The President shall report to the Congress on the results of this study within twelve months after the date of enactment of this Act.

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[5] For text of treaty, see page 34, vol. III.

[6] 22 U.S.C. 3221.

[7] 22 U.S.C. 3222.

INTERNATIONAL UNDERTAKINGS

SEC. 104.[9] (a) Consistent with section 105 of this Act, the President shall institute prompt discussions with other nations and groups of nations, including both supplier and recipient nations, to develop international approaches for meeting future worldwide nuclear fuel needs. In particular, the President is authorized and urged to seek to negotiate as soon as practicable with nations possessing nuclear fuel production facilities or source material, and such other nations and groups of nations, such as the IAEA, as may be deemed appropriate, with a view toward the timely establishment of binding international undertakings providing for—

(1) the establishment of an international nuclear fuel authority (INFA) with responsibility for providing agreed upon fuel services and allocating agreed upon quantities of fuel resources to ensure fuel supply on reasonably terms in accordance with agreements between INFA and supplier and recipient nations;

(2) a set of conditions consistent with subsection (d) under which international fuel assurances under INFA auspices will be provided to recipient nations, including conditions which will ensure that the transferred materials will not be used for nuclear explosive devices;

(3) devising, consistent with the policy goals set forth in section 403 of this Act, feasible and environmentally sound approaches for the siting, development, and management under effective international auspices and inspection of facilities for the provision of nuclear fuel services, including the storage of special nuclear material;

(4) the establishment of repositories for the storage of spent nuclear reactor fuel under effective international auspices and inspection;

(5) the establishment of arrangements under which nations placing spent fuel in such repositories would receive appropriate compensation for the energy content of such spent fuel if recovery of such energy content is deemed necessary or desirable; and

(6) sanctions for violation of the provisions of or for abrogation of such binding international undertakings.

(b) The President shall submit to Congress not later than six months after the date of enactment of this Act proposals for initial fuel assurances, including creation of an interim stockpile of uranium enriched to less than 20 percent in the uranium isotope 235 (low-enriched uranium) to be available for transfer pursuant to a sales arrangement to nations which adhere to strict policies designed to prevent proliferation when and if necessary to ensure continuity of nuclear fuel supply to such nations. Such submission shall include proposals for the transfer of low-enriched uranium up to an amount sufficient to produce 100,000 MWe years of power from light water nuclear reactors, and shall also include proposals for seeking contributions from other supplier nations to such an interim stockpile pending the establishment of INFA.

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[9] 22 U.S.C. 3223.

(c) The President shall, in the report required by section 103, also address the desirability of and options for foreign participation, including investment, in new United States uranium enrichment facilities. This report shall also address the arrangements that would be required to implement such participation and the commitments that would be required as a condition of such participation. This report shall be accompanied by any proposed legislation to implement these arrangements.

(d) The fuel assurances contemplated by this section shall be for the benefit of nations that adhere to policies designated to prevent proliferation. In negotiating the binding international undertakings called for in this section, the President shall, in particular, seek to ensure that the benefits of such undertakings are available to non-nuclear-weapon states only if such states accept IAEA safeguards on all their peaceful nuclear activities, do not manufacture or otherwise acquire any nuclear explosive device, do not establish any new enrichment or reprocessing facilities under their de facto or de jure control, and place any such existing facilities under effective international auspices and inspection.

(e) The report required by section 601 shall include information on the progress made in any negotiations pursuant to this section.

(f)(1) The President may not enter into any binding international undertaking negotiated pursuant to subsection (a) which is not a treaty until such time as such proposed undertaking has been submitted to the Congress and has been approved by concurrent resolution.

(2) The proposals prepared pursuant to subsection (b) shall be submitted to the Congress as part of an annual authorization Act for the Department of Energy.

REEVALUATION OF NUCLEAR FUEL CYCLE

Sec. 105.[9] The President shall take immediate initiatives to invite all nuclear supplier and recipient nations to reevaluate all aspects of the nuclear fuel cycle, with emphasis on alternatives to an economy based on the separation of pure plutonium or the presence of high enriched uranium, methods to deal with spent fuel storage, and methods to improve the safeguards for existing nuclear technology. The President shall, in the first report required by section 601, detail the progress of such international reevaluation.

TITLE II.—UNITED STATES INITIATIVES TO STRENGTHEN THE INTERNATIONAL SAFEGUARDS SYSTEM

POLICY

Sec. 201.[10] The United States is committed to continued strong support for the principles of the Treaty on the Non-Proliferation of

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[9] 22 U.S.C. 3224.

[10] 22 U.S.C. 3241.

Nuclear Weapons, to a strengthened and more effective International Atomic Energy Agency and to a comprehensive safeguards system administered by the Agency to deter proliferation. Accordingly, the United States shall seek to act with other nations to—

(a) continue to strengthen the safeguards program of the IAEA and, in order to implement this section, contribute funds, technical resources, and other support to assist the IAEA in effectively implementing safeguards;

(b) ensure that the IAEA has the resources to carry out the provisions of article XII of the Statute of the IAEA;

(c) improve the IAEA safeguards system (including accountability) to ensure—

(1) the timely detection of a possible diversion of sources or special nuclear materials which could be used for nuclear explosive devices;

(2) the timely dissemination of information regarding such diversion; and

(3) the timely implementation of internationally agreed procedures in the event of such diversion;

(d) ensure that the IAEA receives on a timely basis the data needed for it to administer an effective and comprehensive international safeguards program and that the IAEA provides timely notice to the world community of any evidence of a violation of any safeguards agreement to which it is a party; and

(e) encourage the IAEA, to the maximum degree consistent with the Statute, to provide nations which supply nuclear materials and equipment with the data needed to assure such nations of adherence to bilateral commitments applicable to such supply.

TRAINING PROGRAM

Sec. 202.[11] The Department of Energy, in consultation with the Commission, shall establish and operate a safeguards and physical security training program to be made available to persons from nations and groups of nations which have developed or acquired, or may be expected to develop or acquire, nuclear materials and equipment for use for peaceful purposes. Any such program shall include training in the most advanced safeguards and physical security techniques and technology, consistent with the national security interests of the United States.

NEGOTIATIONS

Sec. 203.[12] The United States shall seek to negotiate with other nations and groups of nations to—

(1) adopt general principles and procedures, including common international sanctions, to be followed in the event that a nation violates any material obligation with respect to the peacefull use of nuclear materials and equipment or nuclear technology, or in the event that any nation violates the

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[11] 22 U.S.C. 3242.

[12] 22 U.S.C. 3243.

principles of the Treaty, including the detonation by a non-nuclear-weapon state of a nuclear explosive device; and

(2) establish international procedures to be followed in the event of diversion, theft, or sabotage of nuclear materials or sabotage of nuclear facilities, and for recovering nuclear materials that have been lost or stolen, or obtained or used by a nation or by any person or group in contravention of the principles of the Treaty.

TITLE III—EXPORT ORGANIZATION AND CRITERIA

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EXPORT LICENSING PROCEDURES

Sec. 304. (a) * * *[13]

(b)[14] Within one hundred and twenty days of the date of enactment of this Act, the Commission shall, after consultations with the Secretary of State, promulgate regulations establishing procedures (1) for the granting, suspending, revoking, or amending of any nuclear export license or exemption pursuant to its statutory authority; (2) for public participation in nuclear export licensing proceedings when the Commission finds that such participation will be in the public interest and will assist the Commission in making the statutory determinations required by the 1954 Act, including such public hearings and access to information as the commission deems appropriate: *Provided*, That judicial review as to any such finding shall be limited to the determination of whether such finding was arbitrary and capricious; (3) for a public written Commission opinion accompanied by the dissenting or separate views of any Commissioner, in those proceedings where one or more Commissioners have dissenting or separate views on the issuance of an export license; and (4) for public notice of Commission proceedings and decisions, and for recording of minutes and votes of the Commission: *Provided further*, That until the regulations required by this subsection have been promulgated, the Commission shall implement the provisions of this Act under temporary procedures established by the Commission.

(c)[14] The procedures to be established pursuant to subsection (b) shall constitute the exclusive basis for hearings in nuclear export licensing proceedings before the Commission and, notwithstanding section 189 a. of the 1954 Act, shall not require the Commission to grant any person an on-the-record hearing in such a proceeding.

(d)[15] Within sixty days of the date of enactment of this Act, the Commission shall, in consultation with the Secretary of State, the Secretary of Energy, the Secretary of Defense, and the Director, promulgate (and may from time to time amend) regulations establishing the levels of physical security which in its judgment are no less strict than those established by any international guidelines to which the United States subscribes and which in its judgment will provide adquate protection for facilities and material referred to in paragraph (3) of section 127 of the 1954 Act taking into consideration variations in risks to security as appropriate.

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[13] Subsec. (a) added a new sec. 126 to the 1954 act regarding export licensing procedures. For text of sec. 126, see page 473.

[14] 42 U.S.C. 2155a.

[15] 42 U.S.C. 2156a.

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COMPONENT AND OTHER PARTS OF FACILITIES

Sec. 309. (a) * * * [16]

(b) [17] The Commission, not later than one hundred and twenty days after the date of the enactment of this Act, shall publish regulations to implement the provisions of subsections b. and c. of section 109 of the 1954 Act. Among other things, these regulations shall provide for the prior consultation by the Commission with the Department of State, the Department of Energy, the Department of Defense, the Department of Commerce, and the Arms Control and Disarmament Agency.

(c) [17] The President, within not more than one hundred and twenty days after the date of enactment of this Act, shall publish procedures regarding the control by the Department of Commerce, over all export items, other than those licensed by the Commission, which could be, if used for purposes other than those for which the export is intended, of significance for nuclear explosive purposes. Among other things, these procedures shall provide for prior consultations, as required, by the Department of Commerce with the Department of State, the Arms Control and Disarmament Agency, the Commission, the Department of Energy, and the Department of Defense.

(d) The amendments to section 109 of the 1954 Act made by this section shall not affect the approval of exports contracted for prior to November 1, 1977, which are made within one year of the date of enactment of such amendments.

TITLE IV—NEGOTIATION OF FURTHER EXPORT CONTROLS

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ADDITIONAL REQUIREMENTS

Sec. 402.[18] (a) Except as specifically provided in any agreement for cooperation, no source or special nuclear material hereafter exported from the United States may be enriched after export without the prior approvals of the United States for such enrichment: *Provided*, That the procedures governing such approval shall be identical to those set forth for the approval of proposed subsequent arrangements under section 131 of the 1954 Act, and any commitments from the recipient which the Secretary of Energy and the Secretary of State deem necessary to ensure that such approval will be obtained prior to such enrichment shall be obtained prior to the submission of the executive branch judgment regarding the export in question and shall be set forth in such submission: *And provided further*, That no source or special nuclear material shall be exported for the purpose of enrichment or reactor fueling to any nation or group of nations which has, after the date of enactment of this Act, entered into a new or amended agreement for cooperation with the United States, except pursuant to such agreement.

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[16] Subsec. (a) amended sec. 109 of the 1954 act. For text of sec. 109, see page 467.

[17] 42 U.S.C. 2139a. The procedures referred to in subsection (c) were issued on June 1, 1978. For text, see vol. III, page 645.

[18] 42 U.S.C. 2153a. The procedures mentioned in the first proviso were issued June 1, 1978. For text, see vol. III, page 645.

(b) In addition to other requirements of law, no major critical component of any uranium enrichment, nuclear fuel reprocessing, or heavy water production facility shall be exported under any agreement for cooperation (except an agreement for cooperation pursuant to subsection 91c., 144b., or 144c. of the 1954 Act) unless such agreement for cooperation specifically designates such components as items to be exported pursuant to the agreement for cooperation. For purposes of this subsection, the term "major critical component" means any component part or group of component parts which the President determines to be essential to the operation of a complete uranium enrichment, nuclear fuel reprocessing, or heavy water production facility.

PEACEFUL NUCLEAR ACTIVITIES

Sec. 403.[19] The President shall take immediate and vigorous steps to seek agreement from all nations and groups of nations to commit themselves to adhere to the following export policies with respect to their peaceful nuclear activities and their participation in international nuclear trade:

(a) No nuclear materials and equipment and no sensitive nuclear technology within the territory of any nation or group of nations, under its jurisdiction, or under its control anywhere will be transferred to the jurisdiction of any other nation or group of nations unless the nation or group of nations receiving such transfer commits itself to strict undertakings including, but not limited to, provisions sufficient to ensure that—

(1) no nuclear materials and equipment and no nuclear technology in, under the jurisdiction of, or under the countrol of any non-nuclear-weapon state, shall be used for nuclear explosive devices for any purpose or for research on or development of nuclear explosives devices for any purpose, except as permitted by Article V, the Treaty;

(2) IAEA safeguards will be applied to all peaceful nuclear activities in, under the jurisdiction of, or under the control of any non-nuclear-weapon state;

(3) adequate physical security measure will be established and maintained by any nation or group of nations on all of its nuclear activities;

(4) no nuclear materials and equipment and no nuclear technology intended for peaceful purposes in, under the jurisdiction of, or under the control of any nation or group of nations shall be transferred to the jurisdiction of any other nation or group of nations which does not agree to stringent undertakings meeting the objectives of this section; and

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[19] 42 U.S.C. 2153a.

(5) no nation or group of nations will assist, encourage, or induce any non-nuclear-weapon state to manufacture or otherwise acquire any nuclear explosive device.

(b)(1) No source or special nuclear material within the territory of any nation or group of nations, under its jurisdiction, or under its control anywhere will be enriched (as described in paragraph aa. (2) of section 11 of the 1954 Act) or reprocessed, no irradiated fuel elements containing such material which are to be removed from a reactor will be altered in form or content, and no fabrication or stockpiling involving plutonium, uranium 233, or uranium enriched to greater than 20 percent in the isotope 235 shall be performed except in a facility under effective international auspices and inspection, and any such irradiated fuel elements shall be transferred to such a facility as soon as practicable after removal from a reactor consistent with safety requirements. Such facilities shall be limited in number to the greatest extent feasible and shall be carefully sited and managed so as to minimize the proliferation and environmental risks associated with such facilities. In addition, there shall be conditions to limit the access of non-nuclear-weapon states other than the host country to sensitive nuclear technology associated with such facilities.

(2) Any facilities within the territory of any nation or group of nations, under its jurisdiction, or under its control anywhere for the necessary short-term storage of fuel elements containing plutonium, uranium 233, or uranium enriched to greater than 20 percent in the isotope 235 prior to placement in a reactor or of irradicated fuel elements prior to transfer as required in subparagraph (1) shall be placed under effective international auspices and inspection.

(c) Adequate physical security measures will be established and maintained with respect to all nuclear activities within the territory of each nation and group of nations, under its jurisdiction, or under its control anywhere, and with respect to any international shipment of significant quantities of source or special nuclear material or irradiated source or special nuclear material, which shall also be conducted under international safeguards.

(d) Nothing in this section shall be interpreted to require international control or supervision of any United States military activities.

RENEGOTIATION OF AGREEMENTS FOR COOPERATION

Sec. 404.[20] (a) The President shall initiate a program immediately to renegotiate agreements for cooperation in effect on the date of enactment of this Act, or otherwise to obtain the agreement of parties to such agreements for cooperation to the undertakings that would be required for new agreements under the 1954 Act. To the extent that an agreement for cooperation in effect on the date of enactment of this Act with a cooperating party contains provisions equivalent to any or all of the criteria set forth in section 127 of the 1954 Act with respect to materials and equipment transferred pursuant thereto or with respect to any special nuclear material used in or produced through the use of any such material or equipment, any renegotiated agreement with that cooperating party shall continue to contain an equivalent provision with respect to such transferred materials and equipment and such special nuclear material. To the extent that an agreement for cooperation in effect on the date of enactment of this Act with a cooperating party does not contain provisions with respect to any nuclear materials and equipment which have previously been transferred under an agreement for cooperation with the United States and which are under the jurisdiction or control of the cooperating party and with respect to any special nuclear material which is used in or produced through the use thereof and which is under the jurisdiction or control of the cooperating party, which are equivalent to any or all of those required for new and amended agreements for cooperation under section 123 a. of the 1954 Act, the President shall vigorously seek to obtain the application of such provisions with respect to such nuclear materials and equipment and such special nuclear material. Nothing in this Act or in the 1954 Act shall be deemed to relinquish any rights which the United States may have under any agreement for cooperation in force on the date of enactment of this Act.

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[20] 42 U.S.C. 2153c.

(b) The President shall annually review each of requirements (1) through (9) set forth for inclusion in agreements for cooperation under section 123 a. of the 1954 Act and the export policy goals set forth in section 401 to determine whether it is in the interest of United States non-proliferation objectives for any such requirements or export policies which are not already being applied as export criteria to be enacted as additional export criteria.

(c) If the President proposed enactment of any such requirements or export policies as additional export criteria or to take any other action with respect to such requirements or export policy goals for the purpose of encouraging adherence by nations and groups of nations to such requirements and policies, he shall submit such a proposal together with an explanation thereof to the Congress.

(d) If the Committee on Foreign Relations of the Senate or the Committee on International Relations of the House of Representatives, after reviewing the President's annual report or any proposed legislation, determines that it is in the interest of the United States non-proliferation objectives to take any action with respect to such requirements or export policy goals, it shall report a joint resolution to implement such determination. Any joint resolution so reported shall be considered in the Senate and the House of Representatives, respectively, under applicable procedures provided for the consideration of resolutions pursuant to subsection 130 b. through g. of the 1954 Act.

AUTHORITY TO CONTINUE AGREEMENTS

Sec. 405.[21] (a) The amendments to section 123 of the 1954 Act made by this Act shall not affect the authority to continue cooperation pursuant to agreements for cooperation entered into prior to the date of enactment of this Act.

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[21] 42 U.S.C. 2155a.

Nothing in this Act shall affect the authority to include dispute settlement provisions, including arbitration, in any agreement made pursuant to an Agreement for Cooperation.

REVIEW

Sec. 406.[22] No court or regulatory body shall have any jurisdiction under any law to compel the performance of or to review the adequacy of the performance of any Nuclear Proliferation Assessment Statement called for in this Act or in the 1954 Act.

PROTECTION OF THE ENVIRONMENT

Sec. 407.[23] The President shall endeavor to provide in any agreement entered into pursuant to section 123 of the 1954 Act for cooperation between the parties in protecting the international environment from radioactive, chemical or thermal contamination arising from peaceful nuclear activities.

TITLE V—UNITED STATES ASSISTANCE TO DEVELOPING COUNTRIES

POLICY; REPORT

Sec. 501.[24] The United States shall endeavor to cooperate with other nations, international institutions, and private organizations in establishing programs to assist in the development of non-nuclear energy resources, to cooperate with both developing and industrialized nations in protecting the international environment from contamination arising from both nuclear and non-nuclear energy activities, and shall seek to cooperate with and aid developing countries in meeting their energy needs through the development of such resources and the application of non-nuclear technologies consistent with the economic factors, the material resources of those countries, and environmental protection. The United States shall additionally seek to encourage other industrialized nations and groups of nations to make commitments for similar cooperation and aid to developing countries. The President shall report annually to Congress on the level of other nations' and groups of nations' commitments under such program and the relation of any such commitments to United States efforts under this title. In cooperating with and providing such assistance to developing countries, the United States shall give priority to parties to the Treaty.

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[22] 42 U.S.C. 2160a.

[23] 42 U.S.C. 2155a. Sec. 1913 of Public Law 95-630 (92 Stat. 3727) provides: "Sec. 1913. No environmental rule, regulation, or procedure shall become effective with regard to exports subject to the provisions of 22 U.S.C. 3201 et seq., the Nuclear Non-Proliferation Act of 1978, until such time as the President has reported to Congress on the progress achieved pursuant to section 407 of the Act (42 U.S.C. 2155a) entitled 'Protection of the Environment' which requires the President to seek to provide, in agreements required under the Act, for cooperation between the parties in protecting the environment from radioactive, chemical or thermal contaminations arising from peaceful nuclear activities."

[24] 42 U.S.C. 2161.

PROGRAMS

Sec. 502. (a) The United States shall initiate a program, consistent with the aims of section 501, to cooperate with developing countries for the purpose of—

(1) meeting the energy needs required for the development of such countries;

(2) reducing the dependence of such countries on petroleum fuels, with emphasis given to utilizing solar and other renewable energy resources; and

(3) expanding the energy alternatives to such countries.

(b) Such program shall include cooperation in evaluating the energy alternatives of developing countries, facilitating international trade in energy commodities, developing energy resources, and applying suitable energy technologies. The program shall include both general and country-specific energy assessments and cooperative projects in resource exploration and production, training, research and development.

(c) As an integral part of such program, the Department of Energy, under the general policy guidance of the Department of State and in cooperation with the Agency for International Development and other Federal agencies as appropriate, shall initiate, as soon as practicable, a program for the exchange of United States scientists, technicians, and energy experts with those of developing countries to implement the purposes of this section.

(d) For the purposes of carrying out this section, there is authorized to be appropriated such sums as are contained in annual authorization Acts for the Department of Energy, including such sums which have been authorized for such purposes under previous legislation.

(e) Under the direction of the President, the Secretary of State shall ensure the coordination of the activities authorized by this title with other related activities of the United States conducted abroad, including the programs authorized by sections 103(c), 106(a)(2), and 119 of the Foreign Assistance Act of 1961.[29]

REPORT

Sec. 503. Not later than twelve months after the date of enactment of this Act, the President shall report to the Congress on the feasibility of expanding the cooperative activities established pursuant to section 502(c) into an international cooperative effort to include a scientific peace corps designed to encourage large numbers of technically trained volunteers to live and work in developing countries for varying periods of time for the purpose of engaging in projects to aid in meeting the energy needs of such countries through the search for and utilization of indigenous energy resources and the application of suitable technology, including the widespread utilization of renewable and unconventional energy technologies. Such report shall also include a discussion of other mechanisms to conduct a coordinated international effort to develop, demonstrate, and encourage the utilization of such technologies in developing countries.

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[29] For text, see vol. I, pages 18 and 25. Sec. 119 of the FA Act, 1961 was repealed.

TITLE VI—EXECUTIVE REPORTING

REPORTS OF THE PRESIDENT

Sec. 601.[99] (a) The President shall review all activities of Government departments and agencies relating to preventing proliferation and shall make a report to Congress in January of 1979 and annually in January of each year thereafter on the Government's efforts to prevent proliferation. This report shall include but not be limited to—

(1) a description of the progress made toward—

(A) negotiating the initiatives contemplated in sections 104 and 105 of this Act;

(B) negotiating the international arrangements or other mutual undertakings contemplated in section 403 of this Act;

(C) encouraging non-nuclear-weapon states that are not party to the Treaty to adhere to the Treaty or, pending such adherence, to enter into comparable agreements with respect to safeguards and to foreswear the devolopment of any nuclear explosive devices, and discouraging nuclear exports to non-nuclear-weapon states which have not taken such steps;

(D) strengthening the safeguards of the IAEA as contemplated in section 201 of this Act; and

(E) renegotiating agreements for cooperation as contemplated in section 404(a) of this Act;

(2) an assessment of the impact of the progress described in paragraph (1) on the non-proliferation policy of the United States; an explanation of the precise reasons why progress has not been made on any particular point and recommendations with respect to appropriate measures to encourage progress; and a statement of what legislative modifications, if any, are necessary in his judgment to achieve the non-proliferation policy of the United States;

(3) a determination as to which non-nuclear-weapon states with which the United States has an agreement for cooperation in effect or under negotiation, if any, have—

(A) detonated a nuclear device; or

(B) refused to accept the safeguards of the IAEA on all of their peaceful nuclear activities; or

(C) refused to give specific assurances that they will not manufacture or otherwise acquire any nuclear explosive device; or

(D) engaged in activities involving source or special nuclear material and having direct significance for the manufacture or acquisition of nuclear explosive devices;

(4) an assessment of whether any of the policies set forth in this Act have, on balance, been counterproductive from the standpoint of preventing proliferation; and

(5) a description of the progress made toward establishing procedures to facilitate the timely processing of requests for

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[99] 22 U.S.C. 3281.

subsequent arrangements and export licenses in order to enhance the reliability of the United States in meeting its commitments to supply nuclear reactors and fuel to nations which adhere to effective non-proliferation policies.

(b) In the first report required by this section, the President shall analyze each civil agreement for cooperation negotiated pursuant to section 123 of the 1954 Act, and shall discuss the scope and adequacy of the requirements and obligations relating to safeguards and other controls therein.

ADDITIONAL REPORTS

Sec. 602.[97] (a) The annual reports to the Congress by the Commission and the Department of Energy which are otherwise required by law shall also include views and recommendations regarding the policies and actions of the United States to prevent proliferation which are the statutory responsibility of those agencies. The Department's report shall include a detailed analysis of the proliferation implications of advanced enrichment and reprocessing techniques, advanced reactors, and alternative nuclear fuel cycles. This part of the report shall include a comprehensive version which includes any relevant classified information and a summary unclassified version.

(b) The reporting requirements of this title are in addition to and not in lieu of any other reporting requirements under applicable law.

(c) The Department of State, the Arms Control and Disarmament Agency, the Department of Commerce, the Department of Energy, and the Commission shall keep the Committees on Foreign Relations and Governmental Affairs of the Senate and the Committee on International Relations of the House of Representatives fully and currently informed with respect to their activities to carry ou the purposes and policies of this Act and to otherwise prevent proliferation, and with respect to the current activities of foreign nations which are of significance from the proliferation standpoint.

(d) Any classified portions of the reports required by this Act shall be submitted to the Senate Foreign Relations Committee and the House International Relations Committee.

(e) Three years after enactment of this Act, the Comptroller General shall complete a study and report to the Congress on the implementation and impact of this Act on the nuclear non-proliferation policies, purposes, and objectives of this Act. The Secretaries of State, Energy, Defense, and Commerce and the Commission and the Director shall cooperate with the Comptroller General in the conduct of the study. The report shall contain such recommendations as the Comptroller General deems necessary to support the nuclear non-proliferation policies, purposes, and objectives of this Act.

SAVING CLAUSE

Sec. 603.[98] (a) All orders, determinations, rules, regulations, permits, contracts, agreements, certificates, licenses, and privileges—

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[97] 22 U.S.C. 3282.
[98] 42 U.S.C. 21[illegible]

(1) which have been issued, made, granted, or allowed to become effective in the exercise of functions which are the subject of this Act, by (i) any agency or officer, or part thereof, in exercising the functions which are affected by this Act, or (ii) any court of competent jurisdiction, and

(2) which are in effect at the time this Act takes effect,

shall continue in effect according to their terms until modified, terminated, superseded, set aside, or repealed as the case may be, by the parties thereto or by any court of competent jurisdiction.

(b) Nothing in this Act shall affect the procedures or requirements applicable to agreements for cooperation entered into pursuant to section 91 c., 144 b., or 144 c. of the 1954 Act or arrangements pursuant thereto as it was in effect immediately prior to the date of enactment of this Act.

(c) Except where otherwise provided, the provisions of this Act shall take effect immediately upon enactment regardless of any requirement for the promulgation of regulations to implement such provisions.

d. Department of Energy Act of 1978—Civilian Applications

Partial text of Public Law 95–238 [S. 1340], 92 Stat. 47 at 59 and 75, approved February 25, 1978

AN ACT To authorize appropriations to the Department of Energy, for energy research, development, and demonstration, and related programs in accordance with section 261 of the Atomic Energy Act of 1954, as amended, section 305 of the Energy Reorganization Act of 1974, and section 16 of the Federal Non-Nuclear Energy Research and Development Act of 1974, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the "Department of Energy Act of 1978—Civilian Applications".

* * * * * * *

Sec. 203.[1] The Secretary of Energy, in cooperation with the Secretary of State, shall report to the Committees on Science and Technology and International Relations of the House of Representatives and the Committees on Energy and Natural Resources and Foreign Relations of the Senate, within six months after the date of the enactment of this Act, on the effects of the April 20, 1977, message from the President of the United States, "Establishing for the United States a Strong and Effective Nuclear Non-Proliferation Policy", on nuclear research and development cooperative agreements. This report shall include impacts of the message and related initiatives through the promulgation, repeal, or modification of Executive orders, Presidential proclamation, treaties, other international agreements, and other pertinent documents of the President, the Executive Office of the President, the administrative agencies, and the departments, on cooperation between the United States and any other nation in the research, development, demonstration, and commercialization of all nuclear fission and nuclear fusion technologies. After the initial report, the Administrator shall report to such Committees on each subsequent major related initiative.

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Sec. 208.[2] (a) The Secretary of Energy shall—

(1) * * *

(2) * * *

(3) initiate and conduct a study involving the prospects for applications of solar photovoltaic energy systems for power generation in foreign countries, particularly lesser developed countries, and the potential for the exportation of these energy systems. This study shall involve the cooperation of the Department of State and the Department of Commerce, as well as

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[1] 22 U.S.C. 2429 note.

[2] 42 U.S.C. 5556a.

other Federal agencies which the Secretary of Energy deems appropriate. A final report shall be submitted to the Congress, as well as a preliminary report within twelve months of the enactment of this Act; and

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Authorization, Appropriations -- International Development Cooperation Act of 1979 (Excerpt)

Public Law 96-53, August 14, 1979

NON-PROLIFERATION OF NUCLEAR WEAPONS

Sec. 507. (a) In accordance with the Nuclear Non-Proliferation Act of 1978, the Congress strongly urges all nations which are not parties to the Treaty on Non-Proliferation of Nuclear Weapons to become parties to that treaty.

(b) Not later than November 1, 1979, the Secretary of State shall submit to the Speaker of the House of Representatives and the chairman of the Committee on Foreign Relations of the Senate, a report specifying, on a country-by-country basis, what efforts the Department of State has made to encourage nations which are not parties to the Treaty on Non-Proliferation of Nuclear Weapons to become parties to that treaty.

U.S. Exports of Low-Enriched Uranium Fuel

Public Law 96-280 [S.J. Res. 89], 94 Stat. 550, approved June 18, 1980

JOINT RESOLUTION Permitting the supply of additional low enriched uranium fuel under international agreements for cooperation in the civil uses of nuclear energy, and for other purposes.

Whereas the Nuclear Non-Proliferation Act of 1978 urges the United States to provide a reliable supply of nuclear fuel to those nations which adhere to policies designed to prevent the proliferation of nuclear weapons; and

Whereas the United States, in order to achieve the goals of that Act should be able to continue to supply low-enriched uranium fuel to nations that have entered into good faith negotiations as called for in section 404(a) of the Act; and

Whereas pending such negotiations, limitations now contained in certain agreements for cooperation on the amount of low-enriched uranium which may be supplied thereunder are insufficient to permit adequate assurance of supplies: Now, therefore, be it.

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled,

Section 1. Limits contained in agreements for cooperation on the amount of low-enriched uranium which may be transferred by or exported from the United States pursuant thereto shall not be construed to preclude transfer or export of amounts of low-enriched uranium in excess of such limits to nations which are parties to the Treaty on the Non-Proliferation of Nuclear Weapons.

Sec. 2. (a) The terms used in this joint resolution shall have the meanings ascribed to them by the Atomic Energy Act of 1954 and by the Nuclear Non-Proliferation Act of 1978.

(b) The term "low-enriched uranium" means uranium enriched to less than 20 per centum in the isotope 235.

THE INTERNATIONAL SECURITY AND DEVELOPMENT COOPERATION ACT OF 1981 (Selected excerpts)
Public Law 97-113, December 29, 1981

PROVISIONS RELATING TO USE OF FUNDS

SEC. 202. Chapter 4 of part II of the Foreign Assistance Act of 1961 is amended by striking out sections 532 and 533 and inserting in lieu thereof the following new sections:

* * *

"SEC. 534. PROHIBITION ON USE OF FUNDS FOR NUCLEAR FACILITIES.—Funds available to carry out this chapter for the fiscal year 1982 and for the fiscal year 1983 may not be used to finance the construction of, the operation or maintenance of, or the supplying of fuel for, any nuclear facility in a foreign country unless the President certifies to the Congress that use of funds for such purpose is indispensable to the achievement of nonproliferation objectives which are uniquely significant and of paramount importance to the United States.

* * *

REPORT ON NUCLEAR ACTIVITIES

SEC. 735. Beginning with the fiscal year 1983 and for each fiscal year thereafter, the President shall prepare and transmit to the Congress, as part of the presentation materials for foreign assistance programs proposed for that fiscal year, a classified report describing the nuclear programs and related activities of any country for which a waiver of section 669 or 670 of the Foreign Assistant Act of 1961 is in effect, including an assessment of—

(1) the extent and effectiveness of International Atomic Energy Agency safeguards at that country's nuclear facilities; and

(2) the capability, actions, and intentions of the government of that country with respect to the manufacture or acquisition of a nuclear explosive device.

The Convention on the Physical Protection of Nuclear Material Implementation Act of 1982.

Public Law 97-351
97th Congress

An Act

To amend title 18 of the United States Code to implement the Convention on the Physical Protection of Nuclear Material, and for other purposes.

Oct. 18, 1982
[H.R. [illegible]]

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SHORT TITLE

Convention on the Physical Protection of Nuclear Material Implementation Act of 1982.
18 USC 831 note.

SECTION 1. This Act may be cited as the "Convention on the Physical Protection of Nuclear Material Implementation Act of 1982".

IMPLEMENTATION OF CONVENTION AND PROHIBITION OF RELATED OFFENSES

SEC. 2. (a) Chapter 39 of title 18 of the United States Code is amended by inserting after the table of sections at the beginning of such chapter the following new section:

"§831. Prohibited transactions involving nuclear materials

18 USC 831.

"(a) Whoever, if one of the circumstances described in subsection (c) of this section occurs—

"(1) without lawful authority, intentionally receives, possesses, uses, transfers, alters, disposes of, or disperses any nuclear material and—

"(A) thereby knowingly causes the death of or serious bodily injury to any person or substantial damage to property; or

"(B) knows that circumstances exist which are likely to cause the death of or serious bodily injury to any person or substantial damage to property;

"(2) with intent to deprive another of nuclear material, knowingly—

"(A) takes and carries away nuclear material of another without authority;

"(B) makes an unauthorized use, disposition, or transfer, of nuclear material belonging to another; or

"(C) uses fraud and thereby obtains nuclear material belonging to another;

"(3) knowingly—

"(A) uses force; or

"(B) threatens or places another in fear that any person other than the actor will imminently be subject to bodily injury;

and thereby takes nuclear material belonging to another from the person or presence of any other;

"(4) intentionally intimidates any person and thereby obtains nuclear material belonging to another;

"(5) with intent to compel any person, international organization, or governmental entity to do or refrain from doing any act, knowingly threatens to engage in conduct described in paragraph (2)(A) or (3) of this subsection;

96 STAT. 1664 “(6) knowingly threatens to use nuclear material to cause death or serious bodily injury to any person or substantial damage to property under circumstances in which the threat may reasonably be understood as an expression of serious purposes;

“(7) attempts to commit an offense under paragraph (1), (2), (3), or (4) of this subsection; or

“(8) is a party to a conspiracy of two or more persons to commit an offense under paragraph (1), (2), (3), or (4) of this subsection, if any of the parties intentionally engages in any conduct in furtherance of such offense;

shall be punished as provided in subsection (b) of this section.

“(b) The punishment for an offense under—

“(1) paragraphs (1) through (7) of subsection (a) of this section is—

“(A) a fine of not more than $250,000; and

“(B) imprisonment—

“(i) for any term of years or for life (I) if, while commiting the offense, the offender knowingly causes the death of any person; or (II) if, while committing an offense under paragraph (1) or (3) of subsection (a) of this section, the offender, under circumstances manifesting extreme indifference to the life of an individual, knowingly engages in any conduct and thereby recklessly causes the death of or serious bodily injury to any person; and

“(ii) for not more than 20 years in any other case; and

“(2) paragraph (8) of subsection (a) of this section is—

“(A) a fine of not more than $250,000; and

“(B) imprisonment—

“(i) for not more than 20 years if the offense which is the object of the conspiracy is punishable under paragraph (1)(B)(i); and

“(ii) for not more than 10 years in any other case.

“(c) The circumstances referred to in subsection (a) of this section are that—

“(1) the offense is committed in the United States or the special maritime and territorial jurisdiction of the United States, or the special aircraft jurisdiction of the United States (as defined in section 101 of the Federal Aviation Act of 1958 (49 U.S.C. 1301);

“(2) the defendant is a national of the United States, as defined in section 101 of the Immigration and Nationality Act (8 U.S.C. 1101);

“(3) at the time of the offense the nuclear material is in use, storage, or transport, for peaceful purposes, and after the conduct required for the offense occurs the defendant is found in the United States, even if the conduct required for the offense occurs outside the United States; or

“(4) the conduct required for the offense occurs with respect to the carriage of a consignment of nuclear material for peaceful purposes by any means of transportation intended to go beyond the territory of the state where the shipment originates beginning
96 STAT. 1665 with the departure from a facility of the shipper in that state and ending with the arrival at a facility of the receiver within the state of ultimate destination and either of such states is the United States.

10 U.S.C. 371 et seq. “(d) The Attorney General may request assistance from the Secretary of Defense under chapter 18 of title 10 in the enforcement of this section and the Secretary of Defense may provide such assistance in accordance with chapter 18 of title 10, except that the Secretary of Defense may provide such assistance through any Department of Defense personnel.

18 U.S.C. 1385. “(e)(1) The Attorney General may also request assistance from the Secretary of Defense under this subsection in the enforcement of this section. Notwithstanding section 1385 of this title, the Secretary of Defense may, in accordance with other applicable law, provide such assistance to the Attorney General if—

“(A) an emergency situation exists (as jointly determined by the Attorney General and the Secretary of Defense in their discretion); and

“(B) the provision of such assistance will not adversely affect the military preparedness of the United States (as determined by the Secretary of Defense in such Secretary's discretion).

"(3) As used in this subsection, the term 'emergency situation' means a circumstance— "Emergency situation."

"(A) that poses a serious threat to the interests of the United States; and

"(B) in which—

"(i) enforcement of the law would be seriously impaired if the assistance were not provided; and

"(ii) civilian law enforcement personnel are not capable of enforcing the law.

"(4) Assistance under this section may include—

"(A) use of personnel of the Department of Defense to arrest persons and conduct searches and seizures with respect to violations of this section; and

"(B) such other activity as is incidental to the enforcement of this section, or to the protection of persons or property from conduct that violates this section.

"(5) The Secretary of Defense may require reimbursement as a condition of assistance under this section.

"(6) The Attorney General may delegate the Attorney General's function under this subsection only to a Deputy, Associate, or Assistant Attorney General.

"(f) As used in this section— Definitions.

"(1) the term 'nuclear material' means material containing any—

"(A) plutonium with an isotopic concentration not in excess of 80 percent plutonium 238;

"(B) uranium not in the form of ore or ore residue that contains the mixture of isotopes as occurring in nature;

"(C) uranium that contains the isotope 233 or 235 or both in such amount that the abundance ratio of the sum of those isotopes to the isotope 238 is greater than the ratio of the isotope 235 to the isotope 238 occurring in nature; or

"(D) uranium 233;

"(2) the term 'international organization' means a public international organization designated as such pursuant to section 1 of the International Organizations Immunities Act (22 U.S.C. 288) or a public organization created pursuant to treaty or other agreement under international law as an instrument through or by which two or more foreign governments engage in some aspect of their conduct of international affairs; 96 STAT. 1666

"(3) the term 'serious bodily injury' means bodily injury which involves—

"(A) a substantial risk of death;

"(B) extreme physical pain;

"(C) protracted and obvious disfigurement; or

"(D) protracted loss or impairment of the function of a bodily member, organ, or mental faculty; and

"(4) the term 'bodily injury' means—

"(A) a cut, abrasion, bruise, burn, or disfigurement;

"(B) physical pain;

"(C) illness;

"(D) impairment of a function of a bodily member, organ, or mental faculty; or

"(E) any other injury to the body, no matter how temporary.".

(b) The table of sections for chapter 39 of title 18 of the United States Code is amended by striking out the items relating to sections 831 through 835 and inserting in lieu thereof the following:

"831. Prohibited transactions involving nuclear materials.".

AMENDMENT TO DEFINITION OF INTERNATIONAL ORGANIZATIONS USED IN DEFINING OFFENSES AGAINST INTERNATIONALLY PROTECTED PERSONS

SEC. 3. Section 1116(b)(5) of title 18 of the United States Code is amended by inserting before the period the following: "or a public organization created pursuant to treaty or other agreement under international law as an instrument through or by which two or more foreign governments engage in some aspect of their conduct of international affairs."

Approved October 18, 1982.

LEGISLATIVE HISTORY—H.R. 5228 (S. 1440):

HOUSE REPORT No. 97-626 (Comm. on the Judiciary).

CONGRESSIONAL RECORD, Vol. 128 (1982):

July 19, 20, considered and passed House.

Sept. 14, considered and passed Senate, amended.

Sept. 21, House concurred in Senate amendment No. 1, disagreed to certain amendments, concurred in others with amendments.

Oct. 1, Senate concurred in House amendments and receded from its disagreements.

WEEKLY COMPILATION OF PRESIDENTIAL DOCUMENTS, Vol. 18, No. 42 (1982): Oct. 19, Presidential statement.

Nuclear Waste Policy Act of 1982

Partial text of Public Law 97–425 [H.R. 3809], 96 Stat. 2201, approved January 7, 1983

AN ACT To provide for the development of repositories for the disposal of high-level radioactive waste and spent nuclear fuel, to establish a program of research, development, and demonstration regarding the disposal of high-level radioactive waste and spent nuclear fuel, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

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TECHNICAL ASSISTANCE TO NON-NUCLEAR WEAPON STATES IN THE FIELD OF SPENT FUEL STORAGE AND DISPOSAL

Sec. 223.[1] (a) It shall be the policy of the United States to cooperate with and provide technical assistance to non-nuclear weapon states in the field of spent fuel storage and disposal.

(b)(1) Within 90 days of enactment of this Act, the Secretary and the Commission shall publish a joint notice in the Federal Register stating that the United States is prepared to cooperate with and provide technical assistance to non-nuclear weapon states in the fields of at-reactor spent fuel storage; away-from-reactor spent fuel storage; monitored, retrievable spent fuel storage; geologic disposal of spent fuel; and the health, safety, and environmental regulation of such activities. The notice shall summarize the resources that can be made available for international cooperation and assistance in these fields through existing programs of the Department and the Commission, including the availability of: (i) data from past or ongoing research and development projects; (ii) consultations with expert Department or Commission personnel or contractors; and (iii) liaison with private business entities and organizations working in these fields.

(2) The joint notice described in the preceding subparagraph shall be updated and reissued annually for 5 succeeding years.

(c) Following publication of the annual joint notice referred to in paragraph (2), the Secretary of State shall inform the governments of non-nuclear weapon states and, as feasible, the organizations operating nuclear powerplants in such states, that the United States is prepared to cooperate with and provide technical assistance to non-nuclear weapon states in the fields of spent fuel storage and disposal, as set forth in the joint notice. The Secretary of State shall also solicit expressions of interest from non-nuclear weapon state governments and non-nuclear weapon state nuclear power reactor operators concerning their participation in expanded United

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[1] 42 U.S.C. 10203.

States cooperation and technical assistance programs in these fields. The Secretary of State shall transmit any such expressions of interest to the Department and the Commission.

(d) With his budget presentation materials for the Department and the Commission for fiscal years 1984 through 1989, the President shall include funding requests for an expanded program of cooperation and technical assistance with non-nuclear weapon states in the fields of spent fuel storage and disposal as appropriate in light of expressions of interest in such cooperation and assistance on the part of non-nuclear weapon state governments and non-nuclear weapon state power reactor operators.

(e) For the purposes of this subsection, the term "non-nuclear weapon state" shall have the same meaning as that set forth in article IX of the Treaty on the Non-Poliferation of Nuclear Weapons (21 U.S.C. 438).[3]

(f) Nothing in this subsection shall authorise the Department or the Commission to take any action not authorised under existing law.

BOSCHWITZ AMENDMENT TO THE DEPARTMENT OF STATE AUTHORIZATION ACT, FISCAL YEARS 1984 AND 1985

Public Law 98-164, November 22, 1983

POLICY TOWARD THE EXPORT OF NUCLEAR-RELATED EQUIPMENT, MATERIALS, OR TECHNOLOGY TO INDIA, ARGENTINA, AND SOUTH AFRICA

SEC. 1007. (a) It is the sense of Congress that the United States Government should disapprove the export of, and should suspend or revoke approval for the export of, any nuclear-related equipment, material, or technology, including nuclear components and heavy water, to the Government of India, Argentina, or South Africa until such time as such government gives the Government of the United States stronger nuclear nonproliferation guarantees. Such guarantees should include—

(1) reliable assurances by such government that it is not engaged in any program leading to the development, testing, or detonation of nuclear explosive devices; and

(2) agreement by such government to accept international safeguards on all its nuclear facilities.

(b) If the President determines, in the case of India's Tarapur reactor, while it is under International Atomic Energy Agency inspection, that certain equipment or nonnuclear material or technology is necessary for humanitarian reasons to protect the health and safety of operations and is not available from a foreign supplier, the President may authorize the export of such equipment or nonnuclear material or technology.

SUMMARIES OF NON PROLIFERATION LEGISLATION (EXCLUDING THE NUCLEAR NON-PROLIFERATION ACT) (From CRS Issue Brief IB85052)

P.L. 85-177 — The International Atomic Energy Participation Act of 1957

Approved Aug. 28, 1957, the Act authorized U.S. participation in the International Atomic Energy Agency. It provides for the appointment of U.S. representatives to the Agency and makes other provisions.

P.L. 85-795 — The Federal Employees International Organization Service Act

Approved Aug. 28, 1958, the Act, in part, repealed Section 6(a) of the IAEA Participation Act of 1957, dealing with pension rights of Federal employees who joined the Agency's staff.

P.L. 89-348 — Executive departments — Reports

Approved Nov. 8, 1965, this Act, in part, repealed the requirement of Section 5 of the IAEA Participation Act that the President report at least annually to Congress on the activities of the Agency and of U.S. participation.

P.L. [illegible]559 — The Foreign Assistance Act of 1974

Approved Dec. 30, 1974, Section 9 amended Section 302 of the Foreign Assistance Act of 1961 to provide for funds in FY75 to strengthen international procedures which are designed to prevent the unauthorized dissemination or use of nuclear materials, and to require the President to report to Congress by July 1, 1975, concerning U.S. actions to strengthen those procedures (IAEA safeguards). Note, President Ford submitted that report to Congress on Sept. 3, 1975.

P.L. 94-329 — The International Security and Arms Export Control Act of 1976

Approved June 30, 1976, the law amended the Foreign Assistance Act by adding a new Section (The Symington Amendment) to reduce nuclear exports and imports that could be used by a country to produce nuclear weapons. A new Section 669 specifies that no funds under this Act, or certain other Acts, may be used for economic assistance, military or security supporting assistance, grants for military training and education, or for military credits or guarantees to any country which: delivers nuclear reprocessing or enrichment equipment, materials, or technology to any other country; or receives such equipment, materials, or technology from any other country, unless before such delivery the supplying country and receiving country agree to place all such items under multilateral auspices and management when available, and the recipient country enters into an agreement with the IAEA to place all such items and all nuclear fuel and facilities in the country under IAEA safeguards. This Section was subsequently changed in 1977 by P.L. 95-92.

P.L. 95-92 -- The International Security Assistance Act of 1977

On Aug. 4, 1977, the President signed the International Security Assistance Act, P.L. 95-92, which amended the Foreign Assistance Act of 1961 by further revising the Symington amendment of 1976 (the Glenn Amendment). The new provisions deal separately with nuclear exports and imports relating to enrichment and to reprocessing of nuclear fuels. Concerning enrichment, the Act revised Section 699 to cut off funds under the International Security Assistance Act or the Arms Export Control Act to any country that delivers nuclear enrichment equipment, materials, or technology to any other country, or receives such equipment, materials, or technology from any other country, unless two conditions are met before delivery. First, the supplying and receiving countries must have agreed to place all such items upon delivery under multilateral auspices and management when available; second, the recipient country must have agreed with the IAEA to place all such items and also all nuclear fuel and facilities in the country under IAEA safeguards. The President may continue to furnish prohibited assistance if he determines and certifies in writing to the House and the Senate that the termination would have a serious adverse effect on vital U.S. interests, and that he has received reliable assurances that the country in question will not acquire or develop nuclear weapons or assist other nations in doing so. The bill also specifies procedures for Senate (but not House) action on any joint resolution to terminate or restrict such assistance.

As for reprocessing, the Act added a new Section 670 which also provides for the cutoff of these funds to any country that delivers nuclear reprocessing equipment, materials, or technology to any other country or receives such equipment, materials, or technology from any other country (except for the transfer of reprocessing technology associated with the investigation, under international evaluation programs in which the U.S. participates, of technologies that are alternatives to pure plutonium reprocessing), or is not a nuclear weapons state under the NPT and detonates a nuclear explosive. The President may continue to furnish such assistance if he determines and certifies in writing to the Congress that the termination of such assistance would be seriously prejudicial to the achievement of U.S. nonproliferation objectives or would otherwise jeopardize the common defense and security. The bill also specifies procedures for Senate (but not House) action on any joint resolution to terminate or restrict the assistance. (Note sections 669 and 670 were further amended in 1981 by P.L. 97-113).

The Act also prohibited use of any funds under the Foreign Assistance Act of 1961 for FY78 to finance the construction of, the operation or maintenance of, or the supply of fuel for, any nuclear powerplant under an agreement for cooperation.

P.L. 95-96 -- the Public Works Appropriation for FY 1978

On Aug. 7, 1977, the President approved P.L. 95-96, an Act making appropriations for public works for water and power development and energy research for FY78. It specifies that up to $14 million is earmarked for a study of the Barnwell Nuclear Fuels Plant (a) to determine if that facility can be utilized in support of the nonproliferation objectives of the United States, and (b) to facilitate activities contributing to the International Fuel Cycle Evaluation Program, provided that the plant shall not be used to process spent fuel from nuclear reactors.

P.L. 95-108 — The Arms Control and Disarmament Act Amendments of 1977

P.L. 95-108 amended the Arms Control and Disarmament Act. One provision authorized appropriation of funds and specified that $2 million should be available only for the purpose of furthering nuclear safeguards programs and activities of the IAEA. P.L. 95-108 was approved on Aug. 17, 1977.

P.L. 95-118 — The International Bank for Reconstruction and Development

Approved Oct. 3, 1977, Title VII provides that the U.S. Government, in connection with its voice and vote in various international financial agencies, shall advance the cause of human rights. With respect to nuclear weapons spread, Section 701(b) directs the Secretary of the Treasury to instruct each Executive Director of these institutions to consider several factors in carrying out his duties. One data is "whether the recipient country has detonated a nuclear device or is not a party to the Treaty on Nonproliferation of Nuclear Weapons, or both" (22 U.S.C. Section 262d (b)).

P.L. 95-143 — The Export-Import Bank Act Extension of 1978

On Oct. 26, 1977, the President approved P.L. 95-143 to extend and amend the Export-Import Bank Act. The extension directed the Secretary of State to report to Congress and to the Board of Directors of the Export-Import Bank if he determines that any country has materially violated, abrogated, or terminated a nuclear safeguards agreement with the International Atomic Energy Agency, or any guarantee or other undertaking in an agreement for nuclear cooperation with the United States, or any non-nuclear weapons state that detonates, after Oct. 26, 1977, a nuclear explosive. The Secretary shall specify which country or countries he has determined to have so acted, and the Board shall not give approval to guarantee, insure, or extend credit, or participate in the extension of credit in support of U.S. exports to such country unless the President determines that it is in the national interest for the Bank to do so and such determination has been reported to the Congress not less than 25 days of continuous session prior to the date of such approval (12 U.S.C. Section 635(b)(4)).

P.L. 95-148 — The Foreign Assistance and Related Programs Appropriations Act, 1978 Foreign Assistance Act

On Oct. 31, 1977, the President approved P.L. 95-148 to appropriate funds for foreign assistance and related programs for FY78. Title IV included a nonproliferation restriction on the Export Import Bank for FY78 funds. It prohibited use of these funds to finance the export of nuclear equipment, fuel, or technology to any country other than a nuclear weapons state that detonated a nuclear explosive after the date of the Act (31 USC 849, 91 Stat. 1238).

P.L. 95-238 — The Department of Energy Act of 1978 — Civilian Applications

On Feb. 28, 1978, the President approved the Department of Energy Act of 1978 — Civilian Applications, which authorized funds for DOE nuclear research and development for FY78. With two exceptions, the Act is the same as the earlier authorization, S. 1811, which President Carter vetoed on Nov. 5, 1977. The changes were deletion of $80 million for continuation of the Clinch River breeder project and provisions for criteria and pricing for uranium enrichment. The authorization contained several provisions relevant to nonproliferation policy and actions. Section 101 included, $20 million for international spent fuel disposition and $13 million for research, development, assessment, evaluation, and other activities at the privately owned Barnwell Nuclear Fuels Plant in South Carolina related to alternative nuclear fuel cycle technologies, safeguards systems, spent fuel storage, and waste management; plus $5 million for research and development on means to reduce the ability to divert plutonium from its intended purposes and to increase the detectability of plutonium if it should be diverted. Section 106 directed the Department of Energy to study the Barnwell plant to determine if it might be used in support of U.S. nonproliferation objectives. Section 107 authorized the Department of Energy to undertake studies, in cooperation with other nations, on a multinational or international basis, designed to determine the general feasibility of the expanding capacity of spent fuel storage facilities, and authorized appropriation of $20 million. Section 203 required the Secretary of Energy, in cooperation with the Secretary of State, to report to the Congress by Aug. 25, 1978, on the effects of President Carter's nonproliferation policy statement of Apr. 20, 1977, upon agreements for cooperation in nuclear research and development. The report is to address impacts of the message and related initiatives of the President and those of the departments and agencies on cooperation between the United States and other nations in research, development, demonstration, and commercialization of nuclear fission and fusion technologies. Thereafter the Secretary of Energy is to report to Congress each subsequent major related initiative.

P.L. 95-481 — The Foreign Assistance and Related Programs Appropriations Act, 1979

On Oct. 18, 1978, the President approved this appropriations Act for FY79. Title IV included the following limitation on use of Export-Import Bank funds for FY79: "None of the funds available during the current fiscal year may be used to make expenditures, contracts, or commitments for the export of nuclear equipment, fuel, or technology to any country other than a nuclear weapon State. . .eligible to receive economic or military assistance under this Act that has detonated a nuclear explosive after the date of enactment. . . ."

P.L. 95-601 -- Authorization appropriations--Nuclear Regulatory Commission, Fiscal Year 1979.

On Nov. 6, 1979, the President approved the NRC's authorizing legislation for FY79, P.L. 95-601. Section 9 requires the NRC to monitor and assist, as requested, the International Nuclear Fuel Cycle Evaluation, and the studies and evaluations of various nuclear fuel cycles by the Department of Energy, and to report to Congress semi-annually through calendar year 1980 and annually through calendar year 1982 on the status of domestic and international evaluations of nuclear fuel cycle systems. This report is to include a summary of information developed by and available to the NRC on the health, safety, and safeguards implications of the leading nuclear fuel cycle technologies.

P.L. 95-630 -- The Financial Institutions Regulatory and Interest Rate Control Act of 1978.

On Nov. 10, 1978, President Carter approved this legislation. Title XIX amended and extended the Export-Import Bank Act of 1945. It amended Section 2(b)(1)(B) of the Act by authorizing the Bank to deny applications for credit for nonfinancial or noncommercial considerations, but only in cases where "the President determines that such action would be in the national interest where such action would clearly and importantly advance United States policy in such areas as international terrorism, nuclear proliferation [emphasis added], environmental protection and human rights."

The Act also amended Section 2(b)(1) of the Export-Import Bank Act to require the Board of Directors to name an officer of the Bank whose duties shall include advising the president of the Bank on ways of promoting exports of goods and services to be used in the development, production, and distribution of non-nuclear renewable energy resources, disseminating information concerning export opportunities, and the availability of Bank support for such activities, and as a liaison between the Bank and the Department of Commerce and other departments and agencies.

Finally, the Act amended Section 9(b) of the Export-Import Bank Act to require the Bank to include in its annual report a description of specific activities and programs undertaken by it to achieve the policy of Section 501 of the Nuclear Non-Proliferation Act (which deals with non-nuclear energy sources) and Section 119 of the Foreign Assistance Act of 1961.

P.L. 96-295 -- The NRC Authorization of Appropriations for FY 1980.

Approved June 30, 1980, it added new Sections 147, 235, and 236 to the Atomic Energy Act of 1954 as amended. Section 147 directed the Commission to prescribe such regulations as necessary to prohibit the unauthorized disclosure of certain safeguards information relating to materials accounting and for security of nuclear materials, plant and equipment, if unauthorized disclosure could reasonably be expected to have "a significant adverse effect on the health and safety of the public, or the common defense and security by significantly increasing the likelihood of theft, diversion, or sabotage of such material or such facility."

Section 235 made it a Federal offense to kill, assault, resist, oppose, impede, intimidate or interfere with any person performing any inspections which are related to any activity or facility licensed by the Commission.

Section 236 made it a Federal offense for any person to intentionally and willfully destroy or damage any production or utilization facility licensed by the Commission, any licensed nuclear waste storage facility, or any nuclear fuel or spent fuel.

P.L. 96-465 — The Foreign Service Act of 1980.

Approved Oct. 17, 1980, this Act, in part, made minor changes to the IAEA participation act by changing references to the new legislation.

P.L. 97-90 — The Department of Energy Military Applications Authorization of 1982.

Approved Dec. 4, 1981, the act added a new Section 148 to the Atomic Energy Act of 1954 as amended. It authorizes the Secretary of Energy to prohibit the unauthorized dissemination of unclassified information pertaining to:

(A) the design of production facilities or utilization facilities [note: this definition includes nuclear power plants];

(B) security measures for the physical protection of such facilities, nuclear materials in them, or nuclear material in transit; or

(C) the design, manufacture, or use of any atomic weapon or component, if contained in any information declassified or removed from the Restricted Data category by the Secretary.

The Secretary may prohibit dissemination of such information only if and to the extent that he determines the unauthorized dissemination could reasonably be expected to have a significant adverse affect on the public health and safety or the common defense and security by significantly increasing the likelihood of illegal production of nuclear weapons or theft, diversion, or sabotage of nuclear materials, equipment, or facilities. In making such a determination, he may consider what the likelihood of an illegal production, theft, diversion, or sabotage would be if the information in question were at no time available for dissemination. The Secretary shall exercise this authority: 1) so as to apply the minimum restrictions needed to protect the public health and safety or the common defense and security; and 2) upon a determination that the unauthorized dissemination could reasonably be expected to result in a significant adverse effect on the public health and safety or the common defense and security by significantly increasing the likelihood of illegal production of nuclear weapons or theft, diversion, or sabotage of nuclear materials, equipment, or facilities. Nothing in this Section authorizes the Secretary to withhold information from the Congress. The new Section 148 of the Atomic Energy Act also provides civil penalties for violation of rules or orders of the Secretary not to exceed $100,000.

P.L. 97-113 — The International Security and Development Cooperation Act of 1981.

On Dec. 29, 1981, President Reagan signed the International Security and Development Cooperation Act of 1981, which included the following provisions relating to U.S. non-proliferation policy.

Limitation on funds.--Section 202 added a new Section 534 to the Foreign Assistance Act of 1961, which prohibits use of economic support funds under Title II of the Act to finance the construction, operation, or maintenance of, or fuel supply for, any nuclear facility in a foreign country unless the President certifies to Congress that use of funds for such purpose is "indispensable to the achievement of nonproliferation objectives which are uniquely significant and of paramount importance to the United States."

A waiver for Pakistan.--Section 736(d) added a new Section 620 E to the Foreign Assistance Act of 1961 to authorize the President to waive the prohibition caused by application of Section 669 at any time through Sept. 30, 1987, to provide assistance to Pakistan if he determines that to do so is "...in the national interest of the United States."

A congressional finding.--Section 737(a) states a congressional finding that:

> ...any transfer of a nuclear explosive device to a non-nuclear weapons state or, in the case of a non-nuclear weapon state, any receipt or detonation of a nuclear explosive device would cause grave damage to bilateral relations between the United States and that Country.

Amendment of Section 669 - enrichment.--Section 737(b) amended Section 669 of the Foreign Assistance Act of 1961 to add a congressional veto by a concurrent resolution -- which does not go to the President for approval -- of the President's continuation of such prohibited aid.

Amendment of Section 670 - plutonium and weapons.--Section 737(c) amended Section 670 of the Foreign Assistance Act of 1961 to add a congressional veto by concurrent resolution, over extension of aid; and to have transfer, receipt, or detonation of a nuclear explosive trigger cutoff of funds.

Concerning supply or receipt of the wherewithall for reprocessing, Section 670 would continue to cut off certain economic and military assistance to any country that delivers nuclear reprocessing equipment, materials, or technology to any other country, or receives such items from any other country, with an exception for international investigation of technologies which are alternatives to pure plutonium reprocessing. As before, the President may continue such assistance if he determines and certifies in writing to Congress that the termination of such assistance would be "seriously prejudicial to the achievement of United States nonproliferation objectives or otherwise jeopardize the common defense and security." The President is to provide specific reasons to Congress for his action. Congress added a specific congressional veto by concurrent resolution of such presidential continuation. This type of congressional veto, however, was struck down in 1983 by the Supreme Court in the Chadha and related cases.

Additionally, Section 670 now contains new triggering actions.

Aid is to be cut off to any country which:

(A) transfers a nuclear explosive device to a non-nuclear weapons state, or

(B) is a non-nuclear weapons state and either

(i) receives a nuclear explosive device, or

(ii) detonates a nuclear explosive device.

The President may continue the prohibited aid for 30 days of continuous session of the Congress if he transmits to Congress a certification that he has determined that ". . . an immediate termination of assistance to that country would be detrimental to the national security of the United States." Such aid cannot continue longer, however, unless permitted by a joint resolution of Congress (which has to be approved by the President to take effect). If the Congress enacts such a joint resolution, the President may continue the assistance if he determines and certifies in writing to Congress that ". . .the termination of such assistance would be seriously prejudicial to the achievement of United States nonproliferation objectives or otherwise jeopardize the common defense and security." The President is to transmit specific reasons for such findings to Congress.

Annual report to Congress.—Section 735 requires the President to make a classified report annually to Congress describing the nuclear programs and related activities of any country for which a waiver of 669 or 670 is in effect. This report is to include an assessment of:

(1) the extent and effectiveness of International Atomic Energy Agency safeguards at that country's nuclear facilities; and

(2) the capability, actions, and intentions of the government of that country with respect to the manufacture or acquisition of a nuclear explosive device.

P.L. 97-377 — Further Continuing Appropriations, 1983.

Approved on Dec. 21, 1982, Section 159 of this act (at 96 STAT 1923) provided that no funds in the joint resolution could be made available for the International Atomic Energy Agency unless its Board of Governors certified to the United States Government that "the State of Israel is allowed to participate fully as a member nation in the activities of that Agency," and the Secretary of State had transmitted such certification to the Congress (the McClure-Kasten amendment).

P.L. 97-351 — The Convention on the Physical Protection of Nuclear Material Implementation Act of 1982.

Approved Oct. 18, 1982, this act amended Title 18 of the U.S. Code to implement the Convention on the Physical Protection of Nuclear Materials. It adds a new paragraph 831 to chapter 39 of 18 U.S.C. to define certain offenses involving nuclear materials as Federal crimes and to specify punishemnt for them. It also authorized the Attorney General to request assistance from the Secretary of Defense in enforcement of the provisions and prescribes conditions for such assistance.

P.L. 97-415 — The Nuclear Regulatory Commission Appropriations Authorization for Fiscal Years 1982 and 1983.

Approved Jan. 4, 1983, Section 14 of this act amended Section 57 of the Atomic Energy Act of 1954 to prohibit the transfer, reprocessing or use by the United States or any other person of special nuclear materials produced in licensed facilities for nuclear explosive purposes. (96 Stat. 2075) Section 16 also amended Section 236 of the AEA with respect to sabotage of nuclear fuel or facilities (Section 236 was added by P.L. 96-295, supra). (The Hart-Simpson amendment)

P.L. 98-164 — The Department of State Authorization Act, Fiscal Years 1984 and 1985.

Approved Nov. 22, 1983, the State Department authorization act contains several provisions relating to U.S. non-proliferation policy.

In Section 115(b) Congress finds that if Israel is illegally expelled, suspended, denied its credentials, or in any other manner denied its right to participate in the United Nations or any specialized agency of the United Nations -- which would include the International Atomic Energy Agency -- the United States "shall suspend its participation" until the illegal action is reversed. Also the United States shall withhold payments of its assessed contributions to the United Nations or a specialized agency during any period in which U.S. participation is suspended under this Section (97 Stat. 1021).

Section 1007, which was proposed by Senator Boschwitz, declares it is "the sense of Congress" that the United States should disapprove the export of, and should suspend or revoke approval for the export of, any nuclear-related equipment, material, or technology, including nuclear components and heavy water, to the governments of India, Argentina, or South Africa until they give the United States "stronger nonproliferation guarantees." Such guarantees should include:

(1) reliable assurances by such government that it is not engaged in any program leading to the development, testing, or detonation of nuclear explosive devices; and

(2) agreement by such government to accept international safeguards on all its nuclear facilities.

If the President determines, in the case of India's Tarapur reactor, while it is under IAEA inspection, that certain equipment or nonnuclear material or technology is necessary for humanitarian reasons to protect the health and safety of operations and is not available from a foreign supplier, the President may authorize the export of such equipment or nonnuclear material or technology (97 Stat. 1059).

95th CONGRESS
1st Session

S. RES. 94

[Report No. 95–103]

IN THE SENATE OF THE UNITED STATES

February 24 (legislative day, February 21), 1977

Mr. Church and Mr. Percy (for themselves, Mr. Anderson, Mr. Bayh, Mr. Biden, Mr. Brooke, Mr. Case, Mr. Clark, Mr. Cranston, Mr. Eagleton, Mr. Glenn, Mr. Gravel, Mr. Hatfield, Mr. Haskell, Mr. Heinz, Mr. Humphrey, Mr. Javits, Mr. Kennedy, Mr. Leahy, Mr. McGovern, Mr. Matsunaga, Mr. Metcalf, Mr. Metzenbaum, Mr. Pell, Mr. Ribicoff, Mr. Riegle, Mr. Stevenson, and Mr. Zorinsky) submitted the following resolution; which was referred to the Committee on Foreign Relations

April 26 (legislative day, February 21), 1977

Reported by Mr. Sparkman, with amendments, and amendments to the preamble

[Omit the part struck through and insert the part printed in italic]

April 28, 1977

Considered, amended, and agreed to

RESOLUTION

International cooperation to curb nuclear proliferation.

Whereas the proliferation of nuclear explosive devices poses a grave threat to continued international progress toward world peace and development;

Whereas the detonation of nuclear explosives, even by developing countries, underscores the urgency of this threat;

Whereas the Senate of the United States ratified the Treaty on the Non-Proliferation of Nuclear Weapons, which committed

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the United States "not in any way to assist, encourage, or induce any non-nuclear-weapons state to manufacture or otherwise acquire nuclear weapons or other nuclear explosive devices . . .";

Whereas nonnuclear weapon states party to the Non-Proliferation Treaty agreed to accept international safeguards to prevent "diversion of nuclear energy from peaceful uses to nuclear weapons or other nuclear explosive devices";

Whereas the proposed transfer of nuclear enrichment and reprocessing facilities to nonnuclear weapons states would enhance their ability to construct nuclear weapons;

Whereas the accumulation of spent reactor fuel, containing potential weapons-grade material, under the sovereign control of nonnuclear weapons states raises immediate dangers of further nuclear-weapons proliferation;

Whereas the continued indigenous development of nuclear facilities (including reprocessing and enrichment) beyond the reach of existing international controls emphasizes the imperative need to increase the scope, comprehensiveness, and effectiveness of international safeguards and other controls on the use of nuclear technology;

Whereas international efforts to control proliferation historically have failed to keep pace with world nuclear development, and

Whereas there is a pressing need for more concerted United

(a) commends the President of the United States for his stated intentions to give diplomatic priority to the pursuit of nonproliferation measures;

(b) endorses and strongly supports active consultations and negotiations with world leaders on the highest level—

(1) to curb the spread of nuclear enrichment and reprocessing facilities to non-nuclear-weapon states and otherwise discourage the diversion of nuclear equipment or materials from peaceful uses to nuclear weapons or other nuclear explosive devices;

(2) to achieve acceptance of international safeguards on all nuclear activities by non-nuclear-weapon states, as well as seek international cooperation to improve the packaging and handling of high-level wastes and to provide for international storage of plutonium, spent reactor fuel, and other sensitive nuclear materials;

(3) to explore possible international arrangements for the provision of nuclear fuel services to

plosive device, or abrogates or materially violates any international non-proliferation controls; and

(5) to strengthen the safeguards of the International Atomic Energy Agency; and

(c) shall act promptly on legislation to enact a clear statement of goals for United States nonproliferation policy providing guidance and support to these President diplomatic initiatives, and to establish a clear statutory framework for the development and implementation of United States nuclear export policy.

IV

97TH CONGRESS
1ST SESSION

H. RES. 177

Calling for the development and implementation of a United States nuclear nonproliferation policy which strengthens the barriers to the further spread of nuclear weapons.

IN THE HOUSE OF REPRESENTATIVES

JULY 13, 1981

Mr. ECKART (for himself, Mrs. FENWICK, and Mr. BINGHAM) submitted the following resolution; which was referred to the Committee on Foreign Affairs

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RESOLUTION

Calling for the development and implementation of a United States nuclear nonproliferation policy which strengthens the barriers to the further spread of nuclear weapons.

Whereas recent international events have focused attention on the dangerous political and military implications of the spread of nuclear weapons capabilities to volatile regions of the world;

Whereas the proliferation of nuclear explosive devices or of the direct capability to manufacture or otherwise acquire such devices poses a grave threat to the security interests of the United States and to continued international progress toward world peace and development;

Whereas it is in the interests of all nations to strengthen the International Atomic Energy Agency's system of safeguards, but at the same time to recognize that safeguards are intrinsically limited for some sensitive technologies and cannot alone prevent nuclear proliferation;

Whereas all nuclear suppliers have an obligation to act decisively and responsibly to stop the spread of sensitive nuclear technologies, equipment, and materials; and

Whereas the International Atomic Energy Agency performs vital monitoring functions but is not equipped with enforcement powers or intelligence capabilities: Now, therefore, be it

Resolved, That—

(1) the President should, in consultation with the Congress, develop and implement a United States nuclear nonproliferation strategy which aggressively and creatively strengthens the political, institutional, and technical barriers to the further spread of nuclear weapons, and specifically which prescribes concrete methods for achieving restraint on the part of all nuclear suppliers;

(2) the President should strongly encourage nations which have not ratified the Treaty on the Non-Proliferation of Nuclear Weapons to do so, and should at the same time seek to strengthen the safeguards operations of the International Atomic Energy Agency;

(3) the President should work in concert with other nuclear suppliers and with the International

Atomic Energy Agency to develop credible sanctions against nations which divert nuclear materials, technologies, or equipment to other than peaceful uses in violation of their obligations to the International Atomic Energy Agency or their obligations under the Treaty on the Non-Proliferation of Nuclear Weapons; and

(4) the President should fully implement the provisions of the Nuclear Non-Proliferation Act of 1978.

97TH CONGRESS
1ST SESSION

S. RES. 179

To improve the international nonproliferation regime.

IN THE SENATE OF THE UNITED STATES

JULY 17 (legislative day, JULY 8), 1981

MR. GLENN (for himself, MR. SPECTER, MR. PERCY, MR. DODD, MR. ZORINSKY, MR. BOSCHWITZ, MR. PELL, MR. CRANSTON, MR. MATHIAS, MR. MATSUNAGA, MR. PRESSLER, and MR. LEVIN) submitted the following resolution; which was considered, amended, and agreed to

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RESOLUTION

To improve the international nonproliferation regime.

Whereas the proliferation of nuclear weapons is a threat to the security of the United States and all other nations of the world and,

Whereas the world community has developed valuable institutions, including the Nuclear Nonproliferation Treaty (NPT) and the International Atomic Energy Agency (IAEA) Safeguards system to deal with the problem of nuclear proliferation and,

Whereas the recent hearings held by the Senate Foreign Relations Committee and the House Foreign Affairs Committee demonstrated serious deficiencies in the NPT and the IAEA systems, and

Whereas despite such deficiencies, there is no prohibition on the transfer of sensitive equipment and technology to politically unstable nations and regions of the world and,

Whereas sensitive nuclear materials, equipment, and technology carry with them the capability of mounting a nuclear weapons option and,

Whereas the United States has traditionally taken a leadership role in raising world consciousness to the dangers of nuclear proliferation and,

Whereas United States nonproliferation actions such as supporting the International Safeguards Regime and the NPT, participating in the Nuclear Suppliers Conferences, and establishing the Nuclear Nonproliferation Act of 1978, have been positive steps in moving toward an effective international nonproliferation regime and,

Whereas it is necessary for significant additional actions to be taken to strengthen the international nonproliferation regime and to raise world consciousness further: Now, therefore, be it

Resolved, That the President should take immediate action to:

(1) Confer on an urgent basis with other nuclear suppliers, as a first step toward achieving a new worldwide consensus on nuclear transfers to consider tightening restrictions on dangerous nuclear trade through measures which include—

(a) establishing, while discussions on a new regime for nuclear trade proceed, a temporary worldwide moratorium on transfers of enrichment and reprocessing equipment and technology, even at the experimental level, to sensitive areas, including the Middle East and South Asia;

(b) limiting the size of all research reactors transferred, eliminating the use of high enriched uranium in such reactors, and obtaining the return of spent research reactor fuel to the country of origin;

(c) extending the list of sensitive nuclear equipment, including components and dual use items, whose export the suppliers only permit under safeguards, with public recording of all sales of such items;

(d) making nuclear transfers only to nonweapon nations which have accepted full-scope safeguards; and

(e) imposing established sanctions in the event of violation of safeguards.

(2) Develop with other IAEA members a strong and effective program for the improvement of the IAEA safeguards regime, specifically considering the practicality of the following measures—

(a) extending the concept of full-scope safeguards to mean safeguards on all nuclear materials, equipment, and facilities within a nonweapon state whether or not such materials, equipment, and facilities have been formally declared to the IAEA;

(b) increasing the quality and quantity of IAEA inspections;

(c) publishing inspection reports; and

(d) extending and upgrading surveillance and containment measures.

(3) Formulate a clear United States policy on enhanced international restrictions on dangerous nuclear trade and on improving the international safeguards regime, and use all feasible leverage to induce others to adopt similar policies.

(4) Call for a prompt reevaluation of world nuclear energy policy, culminating in a conference in order to agree upon ways both to reduce security concerns and to strengthen the nonproliferation regime.

(5) Reaffirm United States policy to cooperate with other countries, particularly in the developing world, to assist them in meeting their energy needs, with nonnuclear energy alternatives considered on an equal basis with nuclear energy in providing such cooperative assistance.

IV

97TH CONGRESS
2D SESSION

H. CON. RES. 340

Reaffirming Senate resolution (S. Res. 179) and House resolution (H. Res. 177) and urging the President to seek agreement at the Versailles economic summit conference that nuclear supplier nations should export nuclear fuel and equipment only to nations that permit full-scope safeguards.

IN THE HOUSE OF REPRESENTATIVES

MAY 12, 1982

Mr. BINGHAM submitted the following concurrent resolution; which was referred to the Committee on Foreign Affairs

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CONCURRENT RESOLUTION

Reaffirming Senate resolution (S. Res. 179) and House resolution (H. Res. 177) and urging the President to seek agreement at the Versailles economic summit conference that nuclear supplier nations should export nuclear fuel and equipment only to nations that permit full-scope safeguards.

Whereas the proliferation of nuclear weapons is a threat to the security of every nation in the world;

Whereas the International Atomic Energy Agency (IAEA) safeguards inspection system was created to verify that nuclear facilities in non-nuclear-weapon states are used strictly for peaceful purposes;

Whereas a number of non-nuclear-weapon states do not permit full-scope safeguards, that is, IAEA inspections of all their nuclear facilities;

Whereas only Canada, Australia, and the United States now require full-scope safeguards as a condition of exports of nuclear fuel and equipment;

Whereas certain other supplier nations have from time to time indicated that they would impose the same restrictions on their nuclear exports provided all other suppliers agree to take the same steps;

Whereas the United States has traditionally taken a leading role in developing agreement to control the spread of nuclear weapons;

Whereas on July 16, 1981, the President stated that the United States will continue "to seek agreement on requiring IAEA safeguards on all nuclear activities in a non-nuclear-weapon state as a condition for any significant new supply commitment";

Whereas on July 17, 1981, the Senate, without dissenting vote, adopted S. Res. 179, calling on the President to implement a series of important initiatives to strengthen the international nonproliferation regime;

Whereas such initiatives are still needed, including consultations on an urgent basis with other nuclear supplier nations to limit nuclear transfers only to non-nuclear-weapon states which have accepted full-scope safeguards;

Whereas on July 17, 1981, the House of Representatives, without dissenting vote, adopted H. Res. 177, calling on the President to take a number of significant steps to strengthen the political, institutional, and technical barriers against the spread of nuclear weapons; and

Whereas such steps are still needed, including the need to achieve restraint on the part of nuclear supplier nations: Now, therefore, be it

Resolved by the House of Representatives (the Senate concurring), That (a) the Senate and the House of Representatives, respectively, hereby reaffirm S. Res. 179 and H. Res. 177; and

(b) The President, as an initial step toward implementing these resolutions, should urgently seek, at the Versailles economic summit conference and through other appropriate channels, to obtain agreement from all nuclear supplier nations that they will export nuclear fuel, equipment, and technology only to those non-nuclear-weapon states that have accepted full-scope safeguards of the International Atomic Energy Agency.

IV

97TH CONGRESS
2D SESSION

S. CON. RES. 96

IN THE HOUSE OF REPRESENTATIVES

MAY 27, 1982

Referred to the Committee on Foreign Affairs

CONCURRENT RESOLUTION

Reaffirming Senate resolution (S. Res. 179) and House resolution (H. Res. 177) and urging the President to seek agreement at the Versailles Summit Conference that nuclear supplier nations should export nuclear fuel and equipment only to nations that permit full-scope safeguards.

Whereas the proliferation of nuclear weapons is a threat to the security of every nation in the world;

Whereas the International Atomic Energy Agency (IAEA) safeguards inspection system was created to verify that nuclear facilities in non-nuclear-weapon states are used strictly for peaceful purposes;

Whereas a number of non-nuclear-weapon states do not permit full-scope safeguards, that is, IAEA inspections of all their nuclear facilities;

Whereas only Canada, Australia, and the United States now require full-scope safeguards as a condition of exports of nuclear fuel and equipment;

Whereas certain other supplier nations have from time to time indicated that they would impose the same restrictions on their nuclear exports provided all other suppliers agree to take the same steps;

Whereas the United States has traditionally taken a leading role in developing agreement to control the spread of nuclear weapons;

Whereas on July 16, 1981, the President stated that the United States will continue "to seek agreement on requiring IAEA safeguards on all nuclear activities in a non-nuclear-weapon state as a condition for any significant new supply commitment";

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Whereas such steps are still needed, including the need to achieve restraint on the part of nuclear supplier nations: Now, therefore, be it

Resolved by the Senate (the House of Representatives concurring), That—

(1) the Senate and the House of Representatives, respectively, reaffirm S. Res. 179 and H. Res. 177; and

(2) the President, as an initial step toward implementing such resolutions, should urgently seek at the Versailles Economic Summit Conference and through other appropriate channels to obtain agreement from all nuclear supplier nations that they will export nuclear fuel, equipment, and technology only to those non-nuclear-weapon states that have accepted full-scope safeguards of the International Atomic Energy Agency.

Passed the Senate May 27 (legislative day, May 25), 1982.

Attest: WILLIAM F. HILDENBRAND,

Secretary.

PART III. PRESIDENTIAL POLICIES, STATEMENTS, AND ORDERS

PRESIDENT FORD

Statement on Nuclear Policy. *October 28, 1976*

WE HAVE known since the age of nuclear energy began more than 30 years ago that this source of energy had the potential for tremendous benefits for mankind and the potential for unparalleled destruction.

On the one hand, there is no doubt that nuclear energy represents one of the best hopes for satisfying the rising world demand for energy with minimum environmental impact and with the potential for reducing dependence on uncertain and diminishing world supplies of oil.

On the other hand, nuclear fuel, as it produces power also produces plutonium, which can be chemically separated from the spent fuel. The plutonium can be recycled and used to generate additional nuclear power, thereby partially offsetting the need for additional energy resources. Unfortunately—and this is the root of the problem—the same plutonium produced in nuclear powerplants can, when chemically separated, also be used to make nuclear explosives.

The world community cannot afford to let potential nuclear weapons material or the technology to produce it proliferate uncontrolled over the globe. The world community must ensure that production and utilization of such material by any nation is carried out under the most stringent security conditions and arrangements.

Developing the enormous benefits of nuclear energy while simultaneously developing the means to prevent proliferation is one of the major challenges facing all nations of the world today.

The standards we apply in judging most domestic and international activities are not sufficiently rigorous to deal with this extraordinarily complex problem. Our answers cannot be partially successful. They will either work, in which case we shall stop proliferation, or they will fail and nuclear proliferation will accelerate as nations initially having no intention of acquiring nuclear weapons conclude that they are forced to do so by the actions of others. Should this happen, we would face a world in which the security of all is critically imperiled. Maintaining international stability in such an environment would be incalculably difficult and dangerous. In times of regional or global crisis, risks of nuclear devastation would be immeasurably increased—if not through direct attack, then through a process of ever-expanding escalation. The problem can be handled as long as we understand it clearly and act wisely in concert with other nations. But we are faced with a threat of tragedy if we fail to comprehend it or to take effective measures.

Thus the seriousness and complexity of the problem place a special burden on those who propose ways to control proliferation. They must avoid the temptation for rhetorical gestures, empty threats, or righteous posturing. They must offer policies and programs which deal with the world as it is, not as we might wish it to be. The goal is to prevent proliferation, not simply to deplore it.

The first task in dealing with the problem of proliferation is to understand the world nuclear situation.

More than 30 nations have or plan to build nuclear powerplants to reap the benefits of nuclear energy. The 1973 energy crisis dramatically demonstrated to all nations not only the dangers of excessive reliance on oil imports but also the reality that the world's supply of fossil fuels is running out. As a result, nuclear energy is now properly seen by many nations as an indispensable way to satisfy rising energy demand without prematurely depleting finite fossil fuel resources. We must understand the motives which are leading these nations, developed and developing, to place even greater emphasis than we do on nuclear power development. For unless we comprehend their real needs, we cannot expect to find ways of working with them to ensure satisfaction of both our and their legitimate concerns. Moreover, several nations besides the United States have the technology needed to produce both the benefits and the destructive potential of nuclear energy. Nations with such capabilities are able to export their technology and facilities.

Thus, no single nation, not even the United States, can realistically hope—by itself—to control effectively the spread of reprocessing technology and the resulting availability of plutonium.

The United States once was the dominant world supplier of nuclear material equipment and technology. While we remain a leader in this field, other suppliers have come to share the international market—with the U.S. now supplying less than half of nuclear reactor exports. In short, for nearly a decade the U.S. has not had a monopoly on nuclear technology. Although our role is large, we are not able to control worldwide nuclear development.

For these reasons, action to control proliferation must be an international cooperative effort involving many nations, including both nuclear suppliers and customers. Common standards must be developed and accepted by all parties. If this is not done, unrestrained trade in sensitive nuclear technology and materials will develop—with no one in a position to stop it.

We in the United States must recognize that interests in nuclear energy vary widely among nations. We must recognize that some nations look to nuclear energy because they have no acceptable energy alternative. We must be sure that our efforts to control proliferation are not viewed by such nations as an act to prevent them from enjoying the benefits of nuclear energy. We must be sure that all nations recognize that the U.S. believes that nonproliferation objectives must take precedence over economic and energy benefits if a choice must be made.

PREVIOUS ACTION

During the past 30 years, the U.S. has been the unquestioned leader in worldwide efforts to assure that the benefits of nuclear energy are made available widely while its destructive uses are prevented. I have given special attention to these objectives during the past 2 years, and we have made important new progress, particularly in efforts to control the proliferation of nuclear weapons capability among the nations of the world.

In 1974, soon after I assumed office, I became concerned that some nuclear supplier countries, in order to achieve competitive advantage, were prepared to offer nuclear exports under conditions less rigorous than we believe prudent. In the fall of that year, at the United Nations General Assembly, the United States proposed that nonproliferation measures be strengthened materially. I also expressed my concern directly to my counterparts in key supplier and recipient nations. I directed the Secretary of State to emphasize multilateral action to limit this dangerous form of competition.

At U.S. initiative, the first meeting of major nuclear suppliers was convened in London in April 1975. A series of meetings and intensive bilateral consultations followed. As a result of these meetings, we have significantly raised international standards through progressive new guidelines to govern nuclear exports. These involve both improved safeguards and controls to prevent diversion of nuclear materials and to guard against the misuse of nuclear technology and physical protection against theft and sabotage. The United States has adopted these guidelines as policy for nuclear exports.

In addition, we have acted to deal with the special dangers associated with plutonium.

—We have prohibited export of reprocessing and other nuclear technologies that could contribute to proliferation.

—We have firmly opposed reprocessing in Korea and Taiwan. We welcome the decisions of those nations to forego such activities. We will continue to discourage national reprocessing in other locations of particular concern.

—We negotiated agreements for cooperation with Egypt and Israel which contain the strictest reprocessing provisions and other nuclear controls ever included in the 20-year history of our nuclear cooperation program.

—In addition, the United States recently completed negotiations to place its civil nuclear facilities under the safeguards of the International Atomic Energy Agency—and the IAEA has approved a proposed agreement for this purpose.

NEW INITIATIVES

Last summer, I directed that a thorough review be undertaken of all our nuclear policies and options to determine what further steps were needed. I have considered carefully the results of that review, held discussions with congressional leaders, and benefited from consultations with leaders of other nations. I have decided that new steps are needed, building upon the progress of the past 2 years. Today, I am announcing a number of actions and proposals aimed at:

—strengthening the commitment of the nations of the world to the goal of nonproliferation and building an effective system of international controls to prevent proliferation;

—changing and strengthening U.S. domestic nuclear policies and programs to support our nonproliferation goals; and

—establishing, by these actions, a sound foundation for the continued and increased use of nuclear energy in the U.S. and in the world in a safe and economic manner.

The task we face calls for an international cooperative venture of unprecedented dimensions. The U.S. is prepared to work with all other nations.

PRINCIPAL POLICY DECISIONS

I have concluded that the reprocessing and recycling of plutonium should not proceed unless there is sound reason to conclude that the world community can effectively overcome the associated risks of proliferation. I believe that avoidance of proliferation must take precedence over economic interests. I have also concluded that the United States and other nations can and should increase their use of nuclear power for peaceful purposes even if reprocessing and recycling of plutonium are found to be unacceptable.

Vigorous action is required domestically and internationally to make these judgments effective.

—I have decided that the United States should greatly accelerate its diplomatic initiatives in conjunction with nuclear supplier and consumer nations to control the spread of plutonium and technologies for separating plutonium.

Effective nonproliferation measures will require the participation and support of nuclear suppliers and consumers. There must be coordination in restraints so that an effective nonproliferation system is achieved, and there must be cooperation in assuring reliable fuel supplies so that peaceful energy needs are met.

—I have decided that the United States should no longer regard reprocessing of used nuclear fuel to produce plutonium as a necessary and inevitable step in the nuclear fuel cycle, and that we should pursue reprocessing and recycling in the future only if they are found to be consistent with our international objectives.

We must ensure that our domestic policies and programs are compatible with our international position on reprocessing and that we work closely with other nations in evaluating nuclear fuel reprocessing.

—The steps I am announcing today will assure that the necessity increase in our use of nuclear energy will be carried on with safety and without aggravating the danger of proliferation.

Even with strong efforts to conserve, we will have increasing demands for energy for a growing American economy. To satisfy these needs, we must rely on increased use of both nuclear energy and coal until more acceptable alternatives are developed. We will continue pushing ahead with work on all promising alternatives such as solar energy but now we must count on the technology that works. We cannot expect a major contribution to our energy supply from alternative technologies until late in this century.

To implement my overall policy decisions, I have decided on a number of policies that are necessary and appropriate to meet our nonproliferation and energy objectives.

—First, our domestic policies must be changed to conform to my decision on deferral of the commercialization of chemical reprocessing of nuclear fuel which results in the separation of plutonium.

—Second, I call upon all nations to join us in exercising maximum restraint in the transfer of reprocessing and enrichment technology and facilities by avoiding such sensitive exports or commitments for a period of at least 3 years.

—Third, new cooperative steps are needed to help assure that all nations have an adequate and reliable supply of energy for their needs. I believe, most importantly, that nuclear supplier nations have a special obligation to assure that customer nations have an adequate supply of fuel for their nuclear powerplants, if those customer nations forego the acquisition of reprocessing and uranium enrichment capabilities and accept effective proliferation controls.

—Fourth, the U.S. must maintain its role as a major and reliable world supplier of nuclear reactors and fuel for peaceful purposes. Our strong position as a supplier has provided the principal basis for our influence and leadership in worldwide nonproliferation efforts. A strong position will be equally important in the future. While reaffirming this Nation's intent to be a reliable supplier, the U.S. seeks no competitive advantage by virtue of the worldwide system of effective nonproliferation controls that I am calling for today.

—Fifth, new efforts must be made to urge all nations to join in a full-scale international cooperative effort—which I shall outline in detail—to develop a system of effective controls to prevent proliferation.

—Sixth, the U.S. must take new steps with respect to its own exports to control proliferation, while seeking to improve multilateral guidelines.

—Seventh, the U.S. must undertake a program to evaluate reprocessing in support of the international policies I have adopted.

—Finally, I have concluded that new steps are needed to assure that we have in place when needed, both in the U.S. and around the world, the facilities for the long-term storage or disposal of nuclear wastes.

ACTIONS TO IMPLEMENT OUR NUCLEAR POLICIES

In order to implement the nuclear policies that I have outlined, major efforts will be required within the United States and by the many nations around the world with an interest in nuclear energy. To move forward with these efforts, I am today taking a number of actions and making a number of proposals to other nations.

I. *Change in U.S. Policy on Nuclear Fuel Reprocessing*

With respect to nuclear fuel reprocessing, I am directing agencies of the executive branch to implement my decision to delay commercialization of reprocessing activities in the United States until uncertainties are resolved. Specifically, I am:

—Directing the Administrator of the Energy Research and Development Administration (ERDA) to:

- change ERDA policies and programs which heretofore have been based on the assumption that reprocessing would proceed;
- encourage prompt action to expand spent fuel storage facilities, thus assuring utilities that they need not be concerned about shutdown of nuclear reactors because of delays; and
- identify the research and development efforts needed to investigate the feasibility of recovering the energy value from used nuclear fuel without separating plutonium.

II. *Restraint in the Transfer of Sensitive Nuclear Technology and Facilities*

Despite the gains in controlling proliferation that have been made, the dangers posed by reprocessing and the prospect of uncontrolled availability of plutonium require further, decisive international action. Effective control of the parallel risk of spreading uranium enrichment technology is also necessary. To meet these dangers:

—I call upon all nations to join with us in exercising maximum restraint in the transfer of reprocessing and enrichment technology and facilities by avoiding such sensitive exports or commitments for a period of at least 3 years.

This will allow suppliers and consumers to work together to establish reliable means for meeting nuclear needs with minimum risk, as we assess carefully the wisdom of plutonium use. As we proceed in these efforts, we must not be influenced by pressures to approve the export of these sensitive facilities.

III. *Assuring an Adequate Energy Supply for Customer Nations*

—I urge nuclear suppliers to provide nuclear consumers with fuel services, instead of sensitive technology or facilities.

Nations accepting effective nonproliferation restraints have a right to expect reliable and economic supply of nuclear reactors and associated, nonsensitive fuel. All such nations would share in the benefits of an assured supply of nuclear fuel, even though the number and location of sensitive facilities to generate this fuel is limited to meet nonproliferation goals. The availability of fuel-cycle services in several different nations can provide ample assurance to consumers of a continuing and stable source of supply.

It is also desirable to continue studying the idea of a few suitably-sited multinational fuel-cycle centers to serve regional needs, when effectively safeguarded and economically warranted. Through these and related means, we can minimize incentives for the spread of dangerous fuel-cycle capabilities.

The United States stands ready to take action, in cooperation with other concerned nations, to assure reliable supplies of nuclear fuel at equitable prices to any country accepting responsible restraints on its nuclear power program with regard to reprocessing, plutonium disposition, and enrichment technology.

—I am directing the Secretary of State to initiate consultations to explore with other nations arrangements for coordinating fuel services and for developing other means of ensuring that suppliers will be able to offer, and consumers will be able to receive, an uninterrupted and economical supply of low-enriched uranium fuel and fuel services.

These discussions will address ways to ensure against economic disadvantage to cooperating nations and to remove any sources of competition which could undermine our common nonproliferation efforts.

To contribute to this initiative, the United States will offer binding letters of intent for the supply of nuclear fuel to current and prospective customers willing to accept such responsible restraints.

—In addition, I am directing the Secretary of State to enter into negotiations or arrangements for mutual agreement on disposition of spent fuel with consumer nations that adopt responsible restraints.

Where appropriate, the United States will provide consumer nations with either fresh, low-enriched uranium fuel or make other equitable arrangements in return for mutual agreement on the disposition of spent fuel where such disposition demonstrably fosters our common and cooperative nonproliferation objectives. The United States seeks no commercial advantage in pursuing options for fuel disposition and assured fuel supplies.

Finally, the United States will continue to expand cooperative efforts with other countries in developing their indigenous nonnuclear energy resources.

The United States has proposed and continues to advocate the establishment of an International Energy Institute, specifically designed to help developing countries match the most economic and readily available sources of energy to their power needs. Through this Institute and other appropriate means, we will offer technological assistance in the development of indigenous energy resources.

IV. *Strengthening the U.S. Role as a Reliable Supplier*

If the United States is to continue its leadership role in worldwide nonproliferation efforts, it must be a reliable supplier of nuclear reactors and fuel for peaceful purposes. There are two principal actions we can take to contribute to this objective:

—I will submit to the new Congress proposed legislation that will permit the expansion of capacity in the United States to produce enriched uranium, including the authority needed for expansion of the Government-owned plant at Portsmouth, Ohio. I will also work with Congress to establish a framework for a private, competitive industry to finance, build, own, and operate enrichment plants.

U.S. capacity has been fully committed since mid-1974 with the result that no new orders could be signed. The Congress did not act on my full proposal and provided only limited and temporary authority for proceeding with the Portsmouth plant. We must have additional authority to proceed with the expansion of capacity without further delay.

—I will work closely with the Congress to ensure that legislation for improving our export controls results in a system that provides maximum assurance that the United States will be a reliable supplier to other nations for the full period of agreements.

One of the principal concerns with export legislation proposed in the last Congress was the fear that foreign customers could be subjected to arbitrary new controls imposed well after a long-term agreement and specific contracts for nuclear powerplants and fuel had been signed. In the case of nuclear plants and fuel, reliable long-term agreements are essential, and we must adopt export controls that provide reliability while meeting nonproliferation objectives.

V. *International Controls Against Proliferation*

To reinforce the foregoing policies, we must develop means to establish international restraints over the accumulation of plutonium itself, whether in separated form or in unprocessed spent fuel. The accumulation of plutonium under national control, especially in a separated form, is a primary proliferation risk.

—I am directing the Secretary of State to pursue vigorously discussions aimed at the establishment of a new international regime to provide for storage of civil plutonium and spent reactor fuel.

The United States made this proposal to the International Atomic Energy Agency and other interested nations last spring.

Creation of such a regime will greatly strengthen world confidence that the growing accumulation of excess plutonium and spent fuel can be stored safely, pending reentry into the nuclear fuel cycle or other safe disposition. I urge the IAEA, which is empowered to establish plutonium depositories, to give prompt implementation to this concept.

Once a broadly representative IAEA storage regime is in operation, we are prepared to place our own excess civil plutonium and spent fuel under its control. Moreover, we are prepared to consider providing a site for international storage under IAEA auspices.

The inspection system of the IAEA remains a key element in our entire nonproliferation strategy. The world community must make sure that the Agency has the technical and human resources needed to keep pace with its expanding responsibilities. At my direction, we have recently committed substantial additional resources to help upgrade the IAEA's technical safeguards capabilities, and I believe we must strengthen further the safeguard functions of the IAEA.

—I am directing the Secretary of State and Administrator of ERDA to undertake a major international effort to ensure that adequate resources for this purpose are made available, and that we mobilize our best scientific talent to support that Agency. Our principal national laboratories with expertise in this area have been directed to provide assistance, on a continuing basis, to the IAEA Secretariat.

The terrible increase in violence and terrorism throughout the world has sharpened our awareness of the need to assure rigorous protection for sensitive nuclear materials and equipment. Fortunately, the need to cope with this problem is now broadly recognized. Many nations have responded to the initiatives which I have taken in this area by materially strengthening their physical security and by cooperating in the development of international guidelines by the IAEA. As a result of consultations among the major suppliers, provision for adequate physical security is becoming a normal condition of supply.

We have an effective physical security system in the United States. But steps are needed to upgrade physical security systems and to assure timely international collaboration in the recovery of lost or stolen materials.

—I have directed the Secretary of State to address vigorously the problem of physical security at both bilateral and multilateral levels, including exploration of a possible international convention.

The United States is committed to the development of the system of international controls that I have here outlined. Even when complete, however, no system of controls is likely to be effective if a potential violator judges that his acquisition of a nuclear explosive will be received with indifference by the international community.

Any material violation of a nuclear safeguards agreement—especially the diversion of nuclear material for use in making explosives—must be universally judged to be an extremely serious affront to the world community, calling for the immediate imposition of drastic sanctions.

—I serve notice today that the United States will, at a minimum, respond to violation by any nation of any safeguards agreement to which we are a party with an immediate cutoff of our supply of nuclear fuel and cooperation to that nation.

We would consider further steps, not necessarily confined to the area of nuclear cooperation, against the violator nation. Nor will our actions be limited to violations of agreements in which we are directly involved. In the event of material violation of any safeguards agreement, particularly agreements with the IAEA, we will initiate immediate consultations with all interested nations to determine appropriate action.

Universal recognition of the total unacceptability of the abrogation or violation of any nonproliferation agreements is one of the most important steps which can be taken to prevent further proliferation. We invite all concerned governments to affirm publicly that they will regard nuclear wrongdoing as an intolerable violation of acceptable norms of international behavior, which would set in motion strong and immediate countermeasures.

VI. *U.S. Nuclear Export Policies*

During the past 2 years, the United States has strengthened its own national nuclear export policies. Our interests, however, are not limited to controls alone. The United States has a special responsibility to share the benefits of peaceful nuclear energy with other countries. We have sought to serve other nations as a reliable supplier of nuclear fuel and equipment. Given the choice between economic benefits and progress toward our nonproliferation goals, we have given, and will continue to give priority to nonproliferation. But there should be no incompatibility between nonproliferation and assisting other nations in enjoying the benefits of peaceful nuclear power if all supplier countries pursue common nuclear export policies. There is need, however, for even more rigorous controls than those now commonly employed, and for policies that favor nations accepting responsible nonproliferation limitations.

—I have decided that we will henceforth apply new criteria in judging whether to enter into new or expanded nuclear cooperation:

- Adherence to the nonproliferation treaty will be a strong positive factor favoring cooperation with a nonnuclear weapon state.
- Nonnuclear weapons states that have not yet adhered to the nonproliferation treaty will receive positive recognition if they are prepared to submit to full fuel cycle safeguards, pending adherence.
- We will favor recipient nations that are prepared to forego, or postpone for a substantial period, the establishment of national reprocessing or enrichment activities or, in certain cases, prepared to shape and schedule their reprocessing and enriching facilities to foster nonproliferation needs.
- Positive recognition will also be given to nations prepared to participate in an international storage regime, under which spent fuel and any separated plutonium would be placed pending use.

Exceptional cases may occur in which nonproliferation will be served best by cooperating with nations not yet meeting these tests. However, I pledge that the Congress will not be asked to approve any new or amended agreement not meeting these new criteria unless I personally determine that the agreement is fully supportive of our nonproliferation goals. In case of such a determination, my reasons will be fully presented to the Congress.

—With respect to countries that are current recipients of U.S. nuclear supply, I am directing the Secretary of State to enter into negotiations with the objective of conforming these agreements to established international guidelines, and to seek through diplomatic initiatives and fuel supply incentives to obtain their acceptance of our new criteria.

We must recognize the need for effective multilateral approaches to nonproliferation and prevent nuclear export controls from becoming an element of commercial competition.

—I am directing the Secretary of State to intensify discussions with other nuclear suppliers aimed at expanding common guidelines for peaceful cooperative agreements so that they conform with these criteria.

In this regard, the United States would discuss ways of developing incentives that can lead to acceptance of these criteria, such as assuring reliable fuel supplies for nations accepting new restraints.

The reliability of American assurances to other nations is an asset that few, if any, nations of the world can match. It must not be eroded. Indeed, nothing could more prejudice our efforts to strengthen our existing nonproliferation understandings than arbitrary suspension or unwarranted delays in meeting supply commitments to countries which are dealing with us in good faith regarding effective safeguards and restraints.

Despite my personal efforts, the 94th Congress adjourned without passing nuclear export legislation which would have strengthened our effectiveness in dealing with other nations on nuclear matters.

—In the absence of such legislation, I am directing the Secretary of State to work closely with the Nuclear Regulatory Commission to ensure proper emphasis on nonproliferation concerns in the nuclear export licensing process.

I will continue to work to develop bipartisan support in Congress for improvements in our nuclear export laws.

VII. Reprocessing Evaluation Program

The world community requires an aggressive program to build the international controls and cooperative regimes I have just outlined. I am prepared to mount such a program in the United States.

—I am directing the Administrator of ERDA to:

- Begin immediately to define a reprocessing and recycle evaluation program consistent with meeting our international objectives outlined earlier in this statement. This program should complement the Nuclear Regulatory Commission's (NRC) ongoing considerations of safety safeguards and environmental requirements for reprocessing and recycling activities, particularly its Generic Environmental Statement on Mixed Oxide Fuels.

- Investigate the feasibility of recovering the energy value from used nuclear fuel without separating our plutonium.

—I am directing the Secretary of State to invite other nations to participate in designing and carrying out ERDA's reprocessing and recycle evaluation program, consistent with our international energy cooperation and nonproliferation objectives. I will direct that activities carried out in the U.S. in connection with this program be subjected to full IAEA safeguards and inspections.

VIII. *Nuclear Waste Management*

The area of our domestic nuclear program dealing with long-term management of nuclear wastes from our commercial nuclear powerplants has not in the past received sufficient attention. In my 1977 Budget, I proposed a fourfold increase in funding for this program, which involves the activities of several Federal agencies. We recently completed a review to determine what additional actions are needed to assure availability in the mid-1980's of a federally-owned and managed repository for long-term nuclear wastes, well before significant quantities of wastes begin to accumulate.

I have been assured that the technology for long-term management or disposal of nuclear wastes is available but demonstrations are needed.

—I have directed the Administrator of ERDA to take the necessary action to speed up this program so as to demonstrate all components of waste management technology by 1978 and to demonstrate a complete repository for such wastes by 1985.

—I have further directed that the first demonstration depository for high-level wastes which will be owned by the Government be submitted for licensing by the independent NRC to assure its safety and acceptability to the public.

In view of the decisions announced today, I have also directed the Administrator of ERDA to assure that the waste repository will be able to handle spent fuel elements as well as the separated and solidified waste that would result if we proceed with nuclear fuel reprocessing.

The United States continues to provide world leadership in nuclear waste management. I am inviting other nations to participate in and learn from our programs.

—I am directing the Secretary of State to discuss with other nations and the IAEA the possibility of establishing centrally located, multinationally controlled nuclear waste repositories so that the number of sites that are needed can be limited.

INCREASED USE OF NUCLEAR ENERGY IN THE UNITED STATES

Even with strong conservation efforts, energy demands in the United States will continue to increase in response to the needs of a growing economy. The only alternative over the next 15 to 20 years to increased use of both nuclear energy and coal is greater reliance on imported oil which will jeopardize our Nation's strength and welfare.

We now have in the United States 62 licensed nuclear plants, providing about 9 percent of our electrical energy. By 1985, we will have from 145 to 160 plants, supplying 20 percent or more of the Nation's electricity.

In many cases, electricity from nuclear plants is markedly cheaper than that produced from either oil or coal-fired plants. Nuclear energy is environmentally preferable in a number of respects to other principal ways of generating electricity.

Commercial nuclear power has an excellent safety record, with nearly 200 plant-years of experience (compiled over 18 chronological years) without a single death from a nuclear accident. I have acted to assure that this record is maintained in the years ahead. For example, I have increased funds for the independent Nuclear Regulatory Commission and for the Energy Research and Development Administration for reactor safety research and development.

The decisions and actions I am announcing today will help overcome the uncertainties that have served to delay the expanded use of nuclear energy in the United States. While the decision to delay reprocessing is significant, it will not prevent us from increasing our use of nuclear energy. We are on the right course with our nuclear power program in America. The changes I am announcing today will ensure that we continue.

My decisions today do not affect the U.S. program of research and development on the breeder reactor. That program assumes that no decision on the commercial operations of breeder reactors, which require plutonium fuel, will be made before 1986.

CONCLUSION

I do not underestimate the challenge represented in the creation of a worldwide program that will permit capturing the benefits of nuclear energy while maintaining needed protection against nuclear proliferation. The challenge is one that can be managed only partially and temporarily by technical measures.

It can be managed fully if the task is faced realistically by nations prepared to forego perceived short-term advantages in favor of fundamental long-term gains. We call upon all nations to recognize that their individual and collective interests are best served by internationally assured and safeguarded nuclear fuel supply, services, and storage. We ask them to turn aside from pursuing nuclear capabilities which are of doubtful economic value and have ominous implications for nuclear proliferation and instability in the world.

The growing international consensus against the proliferation of nuclear weapons is a source of encouragement. But it is certainly not a basis for complacency.

Success in meeting the challenge now before us depends on an extraordinary coordination of the policies of all nations toward the common good. The United States is prepared to lead, but we cannot succeed alone. If nations can work together constructively and cooperatively to manage our common nuclear problems, we will enhance our collective security. And we will be better able to concentrate our energies and our resources on the great tasks of construction rather than consume them in increasingly dangerous rivalry.

Nuclear Power Policy

Statement on Decisions Reached Following a Review. April 7, 1977

There is no dilemma today more difficult to resolve than that connected with the use of nuclear power. Many countries see nuclear power as the only real opportunity, at least in this century, to reduce the dependence of their economic well-being on foreign oil—an energy source of uncertain availability, growing price, and ultimate exhaustion. The U.S., by contrast, has a major domestic energy source—coal—but its use is not without penalties, and our plans also call for the use of nuclear power as a share in our energy production.

The benefits of nuclear power are thus very real and practical. But a serious risk accompanies worldwide use of nuclear power—the risk that components of the nuclear power process will be turned to providing atomic weapons.

We took an important step in reducing the risk of expanding possession of atomic weapons through the nonproliferation treaty, whereby more than 100 nations have agreed not to develop such explosives. But we must go further. The U.S.

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is deeply concerned about the consequences for all nations of a further spread of nuclear weapons or explosive capabilities. We believe that these risks would be vastly increased by the further spread of sensitive technologies which entail direct access to plutonium, highly enriched uranium, or other weapons usable material. The question I have had under review from my first day in office is how can that be accomplished without forgoing the tangible benefits of nuclear power.

We are now completing an extremely thorough review of all the issues that bear on the use of nuclear power. We have concluded that the serious consequences of proliferation and direct implications for peace and security—as well as strong scientific and economic evidence—require:

—a major change in U.S. domestic nuclear energy policies and programs; and

—a concerted effort among all nations to find better answers to the problems and risks accompanying the increased use of nuclear power.

I am announcing today some of my decisions resulting from that review.

First, we will defer indefinitely the commercial reprocessing and recycling of the plutonium produced in the U.S. nuclear power programs. From our own experience, we have concluded that a viable and economic nuclear power program can be sustained without such reprocessing and recycling. The plant at Barnwell, South Carolina, will receive neither Federal encouragement nor funding for its completion as a reprocessing facility.

Second, we will restructure the U.S. breeder reactor program to give greater priority to alternative designs of the breeder and to defer the date when breeder reactors would be put into commercial use.

Third, we will redirect funding of U.S. nuclear research and development programs to accelerate our research into alternative nuclear fuel cycles which do not involve direct access to materials usable in nuclear weapons.

Fourth, we will increase U.S. production capacity for enriched uranium to provide adequate and timely supply of nuclear fuels for domestic and foreign needs.

Fifth, we will propose the necessary legislative steps to permit the U.S. to offer nuclear fuel supply contracts and guarantee delivery of such nuclear fuel to other countries.

Sixth, we will continue to embargo the export of equipment or technology that would permit uranium enrichment and chemical reprocessing.

Seventh, we will continue discussions with supplying and recipient countries alike, of a wide range of international approaches and frameworks that will permit all nations to achieve their energy objectives while reducing the spread of nuclear explosive capability. Among other things, we will explore the establishment of an international nuclear fuel cycle evaluation program aimed at developing alternative fuel cycles and a variety of international and U.S. measures to assure access to nuclear fuel supplies and spent fuel storage for nations sharing common nonproliferation objectives.

We will continue to consult very closely with a number of governments regarding the most desirable multilateral and bilateral arrangements for assuring that nuclear energy is creatively harnessed for peaceful economic purposes. Our intent is to develop wider international cooperation in regard to this vital issue through systematic and thorough international consultations.

Nuclear Power Policy

Remarks and a Question-and-Answer Session With Reporters on Decisions Following a Review of U.S. Policy. April 7, 1977

* * *

The second point I'd like to make before I answer questions is concerning our Nation's efforts to control the spread of nuclear explosive capability. As far back as 30 years ago, our Government made a proposal to the United Nations that there be tight international controls over nuclear fuels and particularly those that might be made into explosives.

Last year during the Presidential campaign, both I and President Ford called for strict controls over fuels to prevent the proliferation—further proliferation of nuclear explosive capability.

There is no dilemma today more difficult to address than that connected with the use of atomic power. Many countries see atomic power as their only real opportunity to deal with the dwindling supplies of oil, the increasing price of oil, and the ultimate exhaustion of both oil and natural gas.

Our country is in a little better position. We have oil supplies of our own, and we have very large reserves of coal. But even coal has its limitations. So, we will ourselves continue to use atomic power as a share of our total energy production.

The benefits of nuclear power, particularly to some foreign countries that don't have oil and coal of their own, are very practical and critical. But a serious risk is involved in the handling of nuclear fuels—the risk that component parts of this power process will be turned to providing explosives or atomic weapons.

We took an important step in reducing this risk a number of years ago by the implementation of the nonproliferation treaty which has now been signed by approximately a hundred nations. But we must go further.

We have seen recently India evolve an explosive device derived from a peaceful nuclear powerplant, and we now feel that several other nations are on the verge of becoming nuclear explosive powers.

The United States is deeply concerned about the consequences of the uncontrolled spread of this nuclear weapon capability. We can't arrest it immediately and unilaterally. We have no authority over other countries. But we believe that these risks would be vastly increased by the further spread of reprocessing capabilities of the spent nuclear fuel from which explosives can be derived.

Plutonium is especially poisonous, and, of course, enriched uranium, thorium, and other chemicals or metals can be used as well.

We are now completing an extremely thorough review of our own nuclear power program. We have concluded that serious consequences can be derived from our own laxity in the handling of these materials and the spread of their use by other countries. And we believe that there is strong scientific and economic evidence that a time for a change has come.

Therefore, we will make a major change in the United States domestic nuclear energy policies and programs which I am announcing today.

We will make a concerted effort among all other countries to find better answers to the problems and risks of nuclear proliferation. And I would like to outline a few things now that we will do specifically.

First of all, we will defer indefinitely the commercial reprocessing and recycling of the plutonium produced in U.S. nuclear power programs.

From my own experience, we have concluded that a viable and adequate economic nuclear program can be maintained without such reprocessing and recycling of plutonium. The plant at Barnwell, South Carolina, for instance, will receive neither Federal encouragement nor funding from us for its completion as a reprocessing facility.

Second, we will restructure our own U.S. breeder program to give greater priority to alternative designs of the breeder other than plutonium, and to defer the date when breeder reactors would be put into commercial use.

We will continue research and development, try to shift away from plutonium, defer dependence on the breeder reactor for commercial use.

Third, we will direct funding of U.S. nuclear research and development programs to accelerate our research into alternative nuclear fuel cycles which do not involve direct access to materials that can be used for nuclear weapons.

Fourth, we will increase the U.S. capacity to produce nuclear fuels, enriched uranium in particular, to provide adequate and timely supplies of nuclear fuels to countries that need them so that they will not be required or encouraged to reprocess their own materials.

Fifth, we will propose to the Congress the necessary legislative steps to permit us to sign these supply contracts and remove the pressure for the reprocessing of nuclear fuels by other countries that do not now have this capability.

Sixth, we will continue to embargo the export of either equipment or technology that could permit uranium enrichment and chemical reprocessing.

And seventh, we will continue discussions with supplying countries and recipient countries, as well, of a wide range of international approaches and frameworks that will permit all countries to achieve their own energy needs while at the same time reducing the spread of the capability for nuclear explosive development.

Among other things—and we have discussed this with 15 or 20 national leaders already—we will explore the establishment of an international nuclear fuel cycle evaluation program so that we can share with countries that have to reprocess nuclear fuel the responsibility for curtailing the ability for the development of explosives.

One other point that ought to be made in the international negotiation field is that we have to help provide some means for the storage of spent nuclear fuel materials which are highly explosive, highly radioactive in nature.

I have been working very closely with and personally with some of the foreign leaders who are quite deeply involved in the decisions that we make. We are not trying to impose our will on those nations like Japan and France and Britain and Germany which already have reprocessing plants in operation. They have a special need that we don't have in that their supplies of petroleum products are not available.

But we hope that they will join with us—and I believe that they will—in trying to have some worldwide understanding of the extreme threat of the further proliferation of nuclear explosive capability.

I'd be glad to answer a few questions.

Nuclear Non-Proliferation

Message to the Congress. April 27, 1977

To the Congress of the United States:

The need to halt nuclear proliferation is one of mankind's most pressing challenges. Members of my Administration are now engaged in international discussions to find ways of controlling the spread of nuclear explosive capability without depriving any nation of the means to satisfy its energy needs. The domestic nuclear policies which I have already put forward will place our nation in a leadership position, setting a positive example for other nuclear suppliers as well as demonstrating the strength of our concern here at home for the hazards of a plutonium economy. Today I am submitting to the Congress a bill which would establish for the United States a strong and effective non-proliferation policy.

This bill relies heavily upon work which the Congress has already done, and I commend the Congress for these valuable initiatives. I look forward to working with the Congress to establish a strong, responsible legislative framework from which we can continue strengthened efforts to halt the spread of nuclear weapons.

Among our shared goals are: an increase in the effectiveness of international safeguards and controls on peaceful nuclear activities to prevent further proliferation of nuclear explosive devices, the establishment of common international sanctions to prevent such proliferation, an effort to encourage nations which have not ratified the Non-Proliferation Treaty to do so at the earliest possible date, and adoption of programs to enhance the reliability of the United States as a supplier of nuclear fuel.

This bill differs from pending proposals, however, in several respects:

1. It defines the immediate nuclear export conditions which we can reasonably ask other nations to meet while we negotiate stricter arrangements. The proposals currently before Congress would impose criteria that could force an immediate moratorium on our nuclear exports, adversely affecting certain allies whose cooperation is needed if we are to achieve our ultimate objective of non-proliferation.

2. It defines additional nuclear export conditions which will be required in new agreements for civil nuclear cooperation. In particular, we will require as a continuing condition of U.S. supply that recipients have all their nuclear activities under IAEA safeguards. I view this as an interim measure and shall make it clear to all potential recipients and to other nuclear suppliers that our first preference and continuing objective, is universal adherence to the Non-Proliferation Treaty.

3. For the near future, it attempts to tighten the conditions for U.S. nuclear cooperation through renegotiation of existing agreements to meet the same standards as those we will require in new agreements. I believe that this approach will better meet our non-proliferation objectives than will the unilateral imposition of new export licensing conditions.

4. It increases the flexibility we need to deal with an extremely complex subject. For example, instead of requiring countries that want our nuclear exports to foreswear fuel enrichment and reprocessing for all time, it allows us to draft new agreements using incentives to encourage countries not to acquire such facilities. It also permits me to grant exceptions when doing so would further our basic aim of non-proliferation. All new cooperation agreements would, of course, be subject to Congressional review.

This bill is intended to reassure other nations that the United States will be a reliable supplier of nuclear fuel and equipment for those who genuinely share our desire for non-proliferation. It will insure that when all statutory standards have been met, export licenses will be issued—or, if the judgment of the Executive Branch and the independent Nuclear Regulatory Commission should differ, that a workable mechanism exists for resolving the dispute.

Since I intend personally to oversee Executive Branch actions affecting non-proliferation, I do not think a substantial reorganization of the responsibility for nuclear exports within the Executive Branch is necessary. This conclusion is shared by the Nuclear Regulatory Commission.

The need for prompt action is great. Until domestic legislation is enacted, other countries will be reluctant to renegotiate their agreements with us, because they will fear that new legislation might suddenly change the terms of cooperation. If the incentives we offer them to renegotiate with us are not attractive enough, the United States could lose important existing safeguards and controls. And if our policy is too weak, we could find ourselves powerless to restrain a deadly worldwide expansion of nuclear explosive capability. I believe the legislation now submitted to you strikes the necessary balance.

JIMMY CARTER

The White House,
April 27, 1977.

Nuclear Non-Proliferation

Fact Sheet on the Proposed Nuclear Non-Proliferation Policy Act of 1977. April 27, 1977

The Nuclear Non-Proliferation Policy Act of 1977, the domestic nuclear policies announced by the President on April 7, and the additional policy decisions included in this fact sheet, are key components of the administration's nuclear non-proliferation policy. The President's policy decisions include:

—new conditions we will require for the granting of nuclear export licenses;

—additional new conditions we will require in new U.S. Agreements for Cooperation. These agreements are the formal, bilateral undertakings which form the basis for civil nuclear interactions with other nations;

—policies the executive branch will follow in making recommendations to the Nuclear Regulatory Commission on the export of sensitive items such as plutonium and highly enriched uranium (the weapons usable form of uranium, known as HEU);

—policies the executive branch will follow in deciding whether to approve a request by another nation to retransfer U.S.-supplied fuel to a third nation for reprocessing;

—policies to improve U.S. reliability as a nuclear fuel supplier by introducing greater clarity and predictability into the export licensing process.

Together, all these policies will place the United States in a leadership position among nuclear suppliers, and will establish a strong and effective non-proliferation policy. These policies have been developed, and must be evaluated, as a complete package. They are intended as a delicately balanced blend of:

—*Denials* for those items, such as reprocessing plants, which we believe create such a large risk that their export should be avoided whenever possible;

—*Controls* over those items and technologies, required by ongoing programs, where improved safeguards and conditions for physical security will substantially reduce the risk. These controls will be backed up by stiff sanctions which would be imposed on violators;

—*Incentives*—the United States fully recognizes that there is no such thing as an effective unilateral non-proliferation policy. We must gain the support of other nations—both suppliers and recipients—if we are to reach our common goal of limiting the spread of nuclear weapons. Hence the administration's program includes substantial elements of incentives, particularly in the areas of: uranium resource assessment; guaranteed access to non-sensitive, low enriched uranium (LEU) nuclear fuel; and spent fuel storage.

The following are key features of the Nuclear Non-Proliferation Policy Act of 1977, and related administration policies.

1. The bill establishes for the first time a statutory requirement forbidding the independent Nuclear Regulatory Commission (NRC) from granting a license to export nuclear materials or facilities until it has been notified by the executive branch of its judgment that the issuance of a license "will not be inimicable to the common defense and security." This judgment will be reached by the Departments of State, Defense, Commerce, the Arms Control and Disarmament Agency, and the Energy Research and Development Administration.

In arriving at these judgments, the executive branch will adhere to the following policies not detailed in the act:

—continue to embargo the export of enrichment and reprocessing plants;

—avoid new commitments to export significant amounts of separated plutonium except for gram quantities for research and analytical uses;

- —avoid new commitments to export significant quantities of highly enriched uranium (HEU) except when the project is of exceptional merit and the use of low enriched fuel or some other less weapons usable material is clearly shown to be technically infeasible;
- —require direct Presidential approval for any supply of HEU greater than 15 kilograms (the approximate amount needed for a bomb);
- —undertake efforts to identify projects and facilities which might be converted to the use of LEU instead of HEU;
- —take steps to minimize inventories of weapons usable uranium abroad.

2. The bill defines the immediate nuclear export conditions which we can reasonably expect other nations to meet while we negotiate stricter agreements for cooperation. These conditions include:

- —A requirement for International Atomic Energy Agency (IAEA) safeguards on all exported items and on any other plutonium or enriched uranium that might be used in the exported facility or produced through its use.
- —A requirement that no U.S. export be used for research or production of any nuclear explosive device.
- —A requirement that no U.S. export be retransferred by a recipient nation to any other nation without the prior approval of the United States.
- —A requirement that no fuel exported from the United States be reprocessed without the prior approval of the United States.

These criteria differ from proposals currently before Congress which include criteria that could force an immediate moratorium on U.S. nuclear exports. Such a moratorium would seriously damage U.S. relations with certain allies whose cooperation is essential if we are to achieve our non-proliferation objectives.

3. The bill defines additional nuclear export conditions which will be required in new agreements for cooperation. These include:

- —A requirement, in the case of non-nuclear weapons states, that IAEA safeguards cover all nuclear materials and equipment regardless of whether these have been supplied by the United States. Fulfillment of this requirement will be a condition of continuing U.S. nuclear supply.

The President has also directed that this requirement be viewed only as an interim measure, and that the United States' first preference, and continuing objective, is universal adherence to the Non-Proliferation Treaty.

—The stipulation that United States cooperation under the agreement shall cease if the recipient detonates a nuclear device or materially violates IAEA safeguards or any guarantee it has given under the agreement.

—A requirement for IAEA safeguards on all U.S.-supplied material and equipment for indefinite duration, whether or not the Agreement for Cooperation remains in force.

—The U.S. right of approval on retransfers extended to all special nuclear material produced through the use of U.S. equipment.

—The U.S. right of approval on reprocessing extended to all special nuclear material produced through use of U.S. equipment.

4. For the near future, the bill proposes to tighten the conditions for U.S. nuclear cooperation through the renegotiation of existing agreements to meet the same standards as those we will require for new agreements (as specified in 3 above).

This approach will better meet U.S. non-proliferation objectives than would an attempt to impose unilaterally new export licensing conditions.

5. The bill provides the flexibility needed to deal with the many different situations and nations involved. For example, it makes the necessary exceptions for licenses under existing multilateral agreements. It also establishes an efficient mechanism for the President and Congress to review cases where the executive branch and the independent NRC differ on the granting of a proposed export license. And it permits the President to grant exceptions from the stiff new conditions required for new agreements for cooperation, if he considers that this is in our overall non-proliferation interest.

6. The bill creates sanctions against the violation of nuclear agreements by providing that no nuclear export shall be granted to any non-nuclear weapons state that, after enactment of this legislation:

—detonates a nuclear explosive device;

—terminates or abrogates IAEA safeguards;

—is found by the President to have materially violated an IAEA agreement or any other guarantee it has given under an agreement for cooperation with the United States;

unless the President determines that such a cutoff would hinder the achievement of U.S. non-proliferation objectives, or would jeopardize the common defense and security.

7. The legislation proposes the establishment of an international Nuclear Fuel Cycle Evaluation Program, aimed at furthering the development of alternative, nuclear fuel cycles which do not provide access to weapons usable material, as announced by the President in his April 7 statement.

8. As an essential element of the international evaluation program, the legislation proposes a number of policies to assure that adequate nuclear fuel supply will be available to all nations as a non-proliferation incentive. These include:

—A policy to assure adequate U.S. uranium enrichment capacity;

—A policy assuring that nuclear exports will be licensed on a timely basis once statutory requirements are met;

—U.S. initiatives to promote international consultations to develop multilateral means for meeting worldwide nuclear fuel needs.

The bill further requires the President to report to the Congress on the progress of these discussions and to propose any legislation he may consider necessary to promote these objectives.

9. The bill commits the United States to work with other nations to strengthen the International Atomic Energy Agency (IAEA) through: contribution of technical resources, support and funding; improving the IAEA safeguards system; and, by assuring that IAEA receives the data needed for it to administer an effective, comprehensive international safeguards program.

233

United States Export Policy

Statement on Reduction of Export Disincentives. February 27, 1980

(Excerpt)

* * *

NUCLEAR EXPORT CONTROLS

The agencies administering our nuclear export controls have taken steps to enhance the United States reliability as a supplier of nuclear materials and equipment, consistent with our firm commitment to prevent the spread of nuclear weapons. For example, we are now providing multiple reload licenses for components for most reactors abroad, and eliminating licensing requirements for nonsignificant quantities of nuclear material. A separate retransfer authorization is no longer required in cases where the retransfer was foreseen and approved in the license issued by the Nuclear Regulatory Commission. Moreover, in dealing with specific cases of proliferation concern, we have had considerable success in harmonizing our nuclear export policies with other key countries.

Further streamlining of our nuclear export licensing system should be considered. Meanwhile, executive branch agencies are undertaking these measures:

1. In considering exports of dual-use items of significance for nuclear explosives, they will focus attention primarily on countries of proliferation concern, minimizing interruption of commerce with countries that have good nonproliferation credentials; and

2. They will continue efforts to harmonize international conditions for approving or denying exports and re-exports of those dual-use items which we continue to license.

Statement on United States Nuclear Nonproliferation Policy

July 16, 1981

Our nation faces major challenges in international affairs. One of the most critical is the need to prevent the spread of nuclear explosives to additional countries. Further proliferation would pose a severe threat to international peace, regional and global stability, and the security interests of the United States and other countries. Our nation has been committed on a bipartisan basis to preventing the spread of nuclear explosives from the birth of the atomic age over 35 years ago. This commitment is shared by the vast majority of other countries. The urgency of this task has been highlighted by the ominous events in the Middle East.

The problem of reducing the risks of nuclear proliferation has many aspects, and we need an integrated approach to deal with it effectively. In the final analysis, the success of our efforts depends on our ability to improve regional and global stability and reduce those motivations that can drive countries toward nuclear explosives. This calls for a strong and dependable United States, vibrant alliances and improved relations with others, and a dedication to those tasks that are vital for a stable world order.

I am announcing today a policy framework that reinforces the longstanding objectives of our nation in nonproliferation and includes a number of basic guidelines.

The United States will:

- seek to prevent the spread of nuclear explosives to additional countries as a fundamental national security and foreign policy objective;
- strive to reduce the motivation for acquiring nuclear explosives by working to improve regional and global stability and to promote understanding of the legitimate security concerns of other states;
- continue to support adherence to the Treaty on the Non-Proliferation of Nuclear Weapons and to the Treaty for the Prohibition of Nuclear Weapons in Latin America (Treaty of Tlatelolco) by countries that have not accepted those treaties;
- view a material violation of these treaties or an international safeguards agreement as having profound consequences for international order and United States bilateral relations, and also view any nuclear explosion by a nonnuclear-weapon state with grave concern;
- strongly support and continue to work with other nations to strengthen the International Atomic Energy Agency to provide for an improved international safeguards regime;
- seek to work more effectively with other countries to forge agreement on measures for combating the risks of proliferation;
- continue to inhibit the transfer of sensitive nuclear material, equipment and technology, particularly where the danger of proliferation demands, and to seek agreement on requiring IAEA safeguards on all nuclear activities in a nonnuclear-weapon state as a condition for any significant new nuclear supply commitment.

I am also announcing that I will promptly seek the Senate's advice and consent to ratification of Protocol I of the Treaty of Tlatelolco.

The United States will cooperate with other nations in the peaceful uses of nuclear energy, including civil nuclear programs to meet their energy security needs, under a regime of adequate safeguards and controls. Many friends and allies of the United States have a strong interest in nuclear power and have, during recent years, lost confidence in the ability of our nation to recognize their needs.

We must reestablish this Nation as a predictable and reliable partner for peaceful nuclear cooperation under adequate safeguards. This is essential to our nonproliferation goals. If we are not such a partner, other countries will tend to go their own ways, and our influence will diminish. This would reduce our effectiveness in gaining the support we need to deal with proliferation problems.

To attain this objective, I am:

- instructing the executive branch agencies to undertake immediate efforts to ensure expeditious action on export requests and approval requests under agreements for peaceful nuclear cooperation where the necessary statutory requirements are met;
- requesting that the Nuclear Regulatory Commission act expeditiously on these matters.

The administration will also not inhibit or set back civil reprocessing and breeder reactor development abroad in nations with advanced nuclear power programs where it does not constitute a proliferation risk.

The United States will support IAEA programs and other international cooperative efforts in the areas of nuclear safety and environmentally sound nuclear waste management.

To carry out these policies, I am instructing the Secretary of State, working with the other responsible agencies, to give priority attention to efforts to reduce proliferation risks, to enhance the international nonproliferation regime and, consistent with United States security interests, to reestablish a leadership role for the United States in international nuclear affairs.

FOR RELEASE 9:45 A.M.
THURSDAY, July 16, 1981

THE WHITE HOUSE

Office of the Press Secretary

FACT SHEET

PRESIDENTIAL STATEMENT ON UNITED STATES NON-PROLIFERATION PEACEFUL NUCLEAR COOPERATION POLICY

The President's statement today sets forth the basic elements of the Administration's policy on nuclear non-proliferation and peaceful nuclear cooperation.

Preventing the spread of nuclear explosives to additional countries remains a fundamental objective of the United States.

The President's statement reflects continuity in U.S. non-proliferation policy objectives for over three decades. It marks a shift in emphasis from the approach of the previous Administration, however, on how best to achieve these objectives. This Administration will seek to pursue non-proliferation more effectively by placing greater emphasis on:

- the need to improve regional and global stability and to reduce motivations that can move countries toward nuclear explosives;
- international cooperation as an essential part of strengthening the international non-proliferation regime; and
- the need to restore the U.S. as a reliable nuclear supplier under an effective regime of safeguards and non-proliferation controls.

Policy Guidelines

The President announced several policy guidelines.

1. The United States will seek to prevent the spread of nuclear explosives to additional countries as a fundamental national security and foreign policy objective.

As noted in the President's statement, further proliferation of nuclear explosives would pose a severe threat to international peace, regional and global stability, and the security interests of the United States and other countries.

2. The United States will strive to reduce the motivation for acquiring nuclear explosives by working to improve regional and global stability, and to promote understanding of the legitimate security concerns of other states.

This shift in emphasis from the previous Administration means that increased recognition will be given to the fact that proliferation is an international political and security problem, and not just a matter of controls on the civil nuclear fuel cycle. The Administration will consider the range of U.S. diplomatic, economic and national security tools to reduce the motivations of other nations to develop nuclear explosives.

3. The United States will continue to support adherence to the Treaty on the Non-Proliferation of Nuclear Weapons and to the Treaty for the Prohibition of Nuclear Weapons in Latin America (Treaty of Tlatelolco) by countries that have not accepted those treaties.

These treaties are major cornerstones in the international non-proliferation regime. The President also announced that the Administration will promptly seek the Senate's advice and consent to ratification of Protocol I of the Treaty of Tlatelolco. This protocol calls on nations outside the treaty zone to apply the denuclearisation provisions of the treaty to their territories in the zone. It has been ratified by the United Kingdom and the Netherlands.

The United States ratified Protocol II to the Treaty of Tlatelolco in 1971. Protocol II basically calls upon nuclear-weapon states to respect the denuclearised status of the zone, not to contribute to violations of the treaty, and not to use or threaten to use nuclear weapons against parties to the treaty in the Latin American region. It has also been ratified by France, the United Kingdom, the People's Republic of China, and the Soviet Union.

4. The United States will view a material violation of these treaties or an international safeguards agreement as having profound consequences for international order and United States bilateral relations, and also view any nuclear explosion by a non-nuclear weapon state with grave concern.

This represents a concern shared by the responsible members of the international community and underlines the gravity of United States concern. The Administration will work diligently with other countries to prevent such violations or nuclear explosions from taking place.

5. The United States will strongly support and continue to work with other nations to strengthen the International Atomic Energy Agency to provide for an improved international safeguards regime.

This reinforces the commitment of the United States to maintaining and strengthening IAEA safeguards and increased safeguards efforts. This is vital to have effective non-proliferation and nuclear cooperation policies, particularly as the magnitude and sensitivity of the IAEA tasks are increasing. The Administration will support the development by the IAEA of improved safeguards techniques, procedures and instrumentation, especially those needed for the larger and more sophisticated nuclear facilities that are likely to be deployed in the coming years.

The Administration will continue to support efforts under the auspices of the IAEA to develop effective regimes for international plutonium storage and improved cooperation in spent fuel management. It will also support the continuing work of the Committee on Assurance of Supply under IAEA auspices.

6. The United States will seek to work more effectively with other countries to forge agreement on measures for combatting the risks of proliferation.

To fulfill this objective the Administration will work actively with other nations to seek uniform non-proliferation conditions for nuclear supply. In particular, the Administration will work to prevent transfers to non-nuclear-weapon states of any significant nuclear material, equipment or technology that would not be subject to IAEA safeguards and to satisfy the following policy guideline.

7. The United States will continue to inhibit the transfer of sensitive nuclear material, equipment and technology, particularly where the danger of proliferation demands, and to seek agreement on requiring IAEA safeguards on all nuclear activities in a non-nuclear-weapon state as a condition for any significant new nuclear supply commitment.

As with the preceding guideline, the Administration will undertake concentrated efforts with other countries to fulfill this objective.

Enhanced Nuclear Cooperation

The President's statement also stresses the longstanding interest of the United States in cooperating with other nations in the peaceful uses of nuclear energy, under a regime of peaceful nuclear cooperation agreements and effective safeguards and controls. As the President's statement notes, many friends and allies of the United States have a strong interest in nuclear power and have, in recent years, lost confidence in the ability of our nation to recognize their needs. We need to restore confidence, trust, and mutual understanding, in the field of international nuclear cooperation within the framework of effective safeguards and controls.

To accomplish this, the President's statement sets forth the objective of reestablishing the United States as a predictable and reliable partner for peaceful nuclear cooperation under effective safeguards. It notes a key reason for this position. If other countries go their own ways, United States influence will be diminished and its effectiveness in gaining the necessary support to deal with proliferation problems will be reduced.

To attain the objective of reliable and predictable supply, the President has:

1. Instructed the Executive Branch agencies to undertake immediate efforts to ensure expeditious action on export requests and approval requests under agreements for peaceful nuclear cooperation, where the necessary statutory requirements are met.

The Administration will also normally authorize retransfers of nuclear material or equipment that precede use in reactors by the time an export license is issued.

2. Request that the Nuclear Regulatory Commission act expeditiously on these matters.

In addition, the President announced that the Administration will not inhibit or setback civil reprocessing and breeder reactor development abroad in nations with advanced nuclear power programs where it does not constitute a proliferation risk. This also marks a shift from the approach of the previous Administration.

The President's announcement reinforces U.S. support for IAEA programs and other international cooperative efforts in the areas of nuclear safety and environmentally sound nuclear waste management. This will include support for the negotiation of a multilateral convention on nuclear safety cooperation and mutual emergency assistance; strengthen international cooperation in environmentally sound waste management; effective physical protection of nuclear material, including wide adherence to the Convention on the Physical Protection of Nuclear Material; and improved security measures for international transport of plutonium and highly enriched uranium. The Administration will also encourage the substitution of lower enriched fuels in research reactors at the earliest possible date.

The President has instructed the Secretary of State, working with the other responsible agencies, to give priority attention to efforts to reduce proliferation risks, to enhance the international non-proliferation regime and, consistent with United States security interests, to reestablish a leadership role for the United States in international nuclear affairs.

Under this mandate a number of reviews will be carried out. These include reviews of:

-- approaches for dealing with non-proliferation and nuclear cooperation issues in specific cases;

-- what steps might be appropriate, consistent with United States non-proliferation objectives, to facilitate or remove unnecessary impediments to commercial relations in the field of nuclear energy;

-- applicable laws, regulations and procedures to determine whether changes should be sought; and

-- possible approaches to develop a more predictable policy for exercising United States rights to approve reprocessing and plutonium use.

Nuclear Energy Policy

Statement Announcing a Series of Policy Initiatives. October 8, 1981

A more abundant, affordable, and secure energy future for all Americans is a critical element of this administration's economic recovery program. While homeowners and business firms have shown remarkable ingenuity and resourcefulness in meeting their energy needs at lower cost through conservation, it is evident that sustained economic growth over the decades ahead will require additional energy supplies. This is particularly true of electricity, which will supply an increasing share of our energy.

If we are to meet this need for new energy supplies, we must move rapidly to eliminate unnecessary government barriers to efficient utilization of our abundant, economical resources of coal and uranium. It is equally vital that the utilities—investor-owned, public, and co-ops—be able to develop new generating capacity that will permit them to supply their customers at the lowest cost, be it coal, nuclear, hydro, or new technologies such as fuel cells.

One of the best potential sources of new electrical energy supplies in the coming decades is nuclear power. The U.S. has developed a strong technological base in the production of electricity from nuclear energy. Unfortunately, the Federal Government has created a regulatory environment that is forcing many utilities to rule out nuclear power as a source of new generating capacity, even when their consumers may face unnecessarily high electric rates as a result. Nuclear power has become entan-

Source: Weekly Compilation of Presidential Documents
October 12, 1981: 1101-1102

gled in a morass of regulations that do not enhance safety but that do cause extensive licensing delays and economic uncertainty. Government has also failed in meeting its responsibility to work with industry to develop an acceptable system for commercial waste disposal, which has further hampered nuclear power development.

To correct present government deficiencies and to enable nuclear power to make its essential contribution to our future energy needs, I am announcing today a series of policy initiatives:

(1) I am directing the Secretary of Energy to give immediate priority attention to recommending improvements in the nuclear regulatory and licensing process. I anticipate that the Chairman of the Nuclear Regulatory Commission will take steps to facilitate the licensing of plants under construction and those awaiting licenses. Consistent with public health and safety, we must remove unnecessary obstacles to deployment of the current generation of nuclear power reactors. The time involved to proceed from the planning stage to an operating license for new nuclear powerplants has more than doubled since the mid-1970's and is presently some 10–14 years. This process must be streamlined, with the objective of shortening the time involved to 6–8 years, as is typical in some other countries.

(2) I am directing that government agencies proceed with the demonstration of breeder reactor technology, including completion of the Clinch River Breeder Reactor. This is essential to ensure our preparedness for longer-term nuclear power needs.

(3) I am lifting the indefinite ban which previous administrations placed on commercial reprocessing activities in the United States. In addition, we will pursue consistent, long-term policies concerning reprocessing of spent fuel from nuclear power reactors and eliminate regulatory impediments to commerical interest in this technology, while ensuring adequate safeguards.

It is important that the private sector take the lead in developing commercial reprocessing services. Thus I am also requesting the Director of the Office of Science and Technology Policy, working with the Secretary of Energy, to undertake a study of the feasibility of obtaining economical plutonium supplies for the Department of Energy by means of a competitive procurement. By encouraging private firms to supply fuel for the breeder program at a cost that does not exceed that of government-produced plutonium, we may be able to provide a stable market for private sector reprocessing and simultaneously reduce the funding needs of the U.S. breeder demonstration program.

(4) I am instructing the Secretary of Energy, working closely with industry and State governments, to proceed swiftly toward deployment of means of storing and disposing of commercial, high-level radioactive waste. We must take steps now to accomplish this objective and demonstrate to the public that problems associated with management of nuclear waste can be resolved.

(5) I recognize that some of the problems besetting the nuclear option are of a deep-seated nature and may not be quickly resolved. Therefore, I am directing the Secretary of Energy and the Director of the Office of Science and Technology Policy to meet with representatives from the universities, private industry, and the utilities, and requesting them to report to me on the obstacles which stand in the way of increased use of nuclear energy and the steps needed to overcome them in order to assure the continued availability of nuclear power to meet America's future energy needs, not later than September 30, 1982.

Eliminating the regulatory problems that have burdened nuclear power will be of little use if the utility sector cannot raise the capital necessary to fund construction of new generating facilities. We have already taken significant steps to improve the climate for capital formation with the passage of my program for economic recovery. The tax bill contains substantial incentives designed to attract new capital into industry.

Safe commercial nuclear power can help meet America's future energy needs. The policies and actions that I am announcing today will permit a revitalization of the U.S. industry's efforts to develop nuclear power. In this way, native American genius, not arbitrary Federal policy, will be free to provide for our energy future.

EXCERPT FROM DEPARTMENT OF STATE NOONTIME PRESS BRIEFING JUNE 9, 1982, RE THE PRESIDENT'S POLICY ON PLUTONIUM

Q Could you confirm the AP story which was carried by The Washington Post this morning on new U.S. policy on nuclear reprocessing?

A On nuclear reprocessing?

Q Yes.

A You will recall that the Presidential policy statement on nuclear cooperation and non-proliferation of July 16, 1981 directed the Secretary of State, in cooperation with other responsible agencies, to give priority attention to efforts to reduce proliferation risks, to enhance the international non-proliferation regime and, consistent with United States security interests, to re-establish a leadership role for the United States in international nuclear affairs. Under this mandate, one of the follow-on reviews has focused on approaches for a more predictable policy for exercising U.S. rights to approve reprocessing and use of plutonium subject to U.S. control under our peaceful nuclear cooperation agreements.

That review has now been completed, and the President has decided that in certain cases the United States will offer to work out predictable, programmatic arrangements for reprocessing and plutonium use for civilian power and research needs, in the context of seeking new or amended agreements as required by law. These agreements would involve only countries with effective commitments to non-proliferation, where there are advanced nuclear power programs, and where such activities do not constitute a proliferation risk and are under effective safeguards and controls.

U.S. approvals will be given only if U.S. statutory criteria are met, and will be valid only as long as these criteria and other conditions in the agreements continue to apply.

It should be noted that the United States has been approving reprocessing requests on an ad hoc, case-by-case basis under existing agreements for many years. What the President has now approved is a new approach to granting long-term approvals in certain cases for the life of specific, carefully defined programs, as long as the conditions I have described are met.

Q Could we have a copy of that?

A Yes, I'll be happy to provide a copy of that.

(pp. 15, 16 of transcript)

U. S. DEPARTMENT OF STATE
OES PRESS GUIDANCE June 9, 1982

Reprocessing and Plutonium-Use Policy

Q: The Washington Post reports that the President has approved a new U.S. policy to allow foreign countries to process nuclear fuel they have obtained from the U.S. and to use the Plutonium recovered in this process. What can you tell us about this new policy and what it means?

A: -- You will recall that the Presidential policy statement on nuclear cooperation and non-prolifertion (July 16, 1981) directed the Secretary of State, in cooperation with other responsible agencies, to give priority attention to efforts to reduce proliferation risks, to enhance the international non-proliferation regime and, consistent with United States security interests, to re-establish a leadership role for the United States in international nuclear affairs. Under this mandate one of the follow-on reviews has focused on approaches for a more predictable policy for exercising U.S. rights to approve reprocessing and use of plutonium subject to U.S. control under our peaceful nuclear cooperation agreements.

-- That review has now been completed and the President has decided that in certain cases the United States will offer to work out predictable, programmatic arrangements for reprocessing and plutonium use for civilian power and research needs, in the context of seeking new or amended agreements as required by law. These agreements would involve only countries with effective commitments to non-proliferation, where there are advanced nuclear power programs and where such activities do not constitute a proliferation risk and are under effective safeguards and controls.

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-- It should be noted that the U.S. has been approving reprocessing requests on an ad hoc, case-by-case basis under existing agreements for many years. What the President has now approved is a new approach to granting long-term approvals in certain cases for the life of specific, carefully defined programs, as long as the conditions I have described are met.

Q: What concrete form will these agreements you hope to negotiate take?

A: -- The President has approved guidelines for negotiations with a limited number of other governments. Pending the results of these negotiations it would not be appropriate to get into a discussion of the details of the arrangements we hope to reach.

Q: Which countries meet the criteria you have set out for negotiating these agreements on reprocessing and plutonium use?

A: -- Japan and EURATOM are the obvious examples. Some other Western European countries may meet criteria for much more limited approvals.

Q: What are the implications of this decision? Is there a possibility that "the world will soon be awash in plutonium"?

A: We will agree to the reprocessing of US-origin nuclear fuel and use of plutonium recovered in this process only where it is safe from a non-proliferation point of view. We will not grant such approvals for activities or transfers to countries where it would pose a proliferation risk. We look forward in fact to more effective controls on plutonium generally.

STATEMENT OF UNDER SECRETARY OF STATE RICHARD T. KENNEDY BEFORE THE SUBCOMMITTEE ON ENERGY, NUCLEAR PROLIFERATION AND GOVERNMENT PROCESSES, COMMITTEE ON GOVERNMENT AFFAIRS, UNITED STATES SENATE. September 9, 1982. (Excerpt)

Mr. Chairman:

I appreciate the opportunity to testify before this committee to discuss recent developments in U.S. non-proliferation policy, most particularly the approach of this Administration toward the reprocessing of nuclear material subject to U.S. consent rights and the use of plutonium produced from that material in certain countries. This hearing comes at an especially appropriate time in view of the numerous misunderstandings and mischaracterizations of the reprocessing and plutonium use policy which President Reagan approved in June of this year. It is very important to set the record straight on this matter since in my view our approach represents the most realistic and effective means of advancing our non-proliferation objectives at this time. In the course of explaining what our policy on these issues is and what it is not, I will seek to answer the specific questions which you have asked.

In his July 16, 1981, message on nuclear cooperation and non-proliferation, President Reagan stressed a number of key themes. Two themes are particularly relevant to the Administration's position on foreign reprocessing and plutonium use.

First, he stated that as one of the many elements of the Administration's overall non-proliferation policy, the United States would continue to inhibit the transfer of sensitive nuclear material, equipment and technology, particularly where the danger of proliferation demands. Underlying this policy is a long-standing US recognition of the serious risks associated with reprocessing and other sensitive technologies, the need for great caution and restraint in dealing with them, and the importance of limiting sensitive facilities and activities to as few locations as possible under adequate safeguards and only where there is no significant risk of proliferation.

The President also emphasized that an essential step in achieving our non-proliferation goals must be the reestablishment of this nation as a reliable partner for nuclear cooperation under adequate safeguards. In this connection, he announced that the U.S. will not inhibit or setback civil reprocessing and breeder reactor development abroad in nations with advanced nuclear power programs where it does not constitute a proliferation risk.

Consistent with this position, in June the President decided on a modified and limited approach toward the reprocessing of material subject to U.S. consent rights and the use of plutonium derived from that material in certain countries.

This approach is primarily designed to give our close allies in EURATOM and Japan a firmer and more predictable basis upon which to plan their vital energy programs while at the same time furthering our non-proliferation objectives, including strengthened controls over civil plutonium.

Specifically, we are offering Japan and the countries of EURATOM new, long-term arrangements for implementation of U.S. consent rights over the reprocessing and use of material subject to our agreements for peaceful nuclear cooperation. This advance, long-term approval would apply only for facilities and activities which we determine meet our strict statutory criteria. We are also prepared to state our intention to consent to such activities in future programs when we have sufficient information about them to make the necessary determinations under our law.

These offers are being made in the context of seeking new or amended peaceful nuclear cooperation agreements with Japan and EURATOM, which would be subject to Congressional review. The approvals would be valid only as long as the conditions provided in the agreement, including non-proliferation and statutory conditions, continue to be met. Our willingness to take these steps presumes the continued strong commitment of these countries to our common non-proliferation efforts and to developing and implementing more effective controls over plutonium.

Providing advance consent will not open the floodgates to the widespread use of plutonium. We are proposing this arrangement only to those few nations which have well-defined and coherent, advanced nuclear programs and where reprocessing and plutonium use do not constitute a proliferation danger. The President's decision limits the offer of advance consent for these activities, therefore, to Japan and the countries of EURATOM, nations which regard the uses of plutonium as crucial to meeting their future nuclear energy needs. Moreover, some of these countries already have reprocessing technology as well as active research, development and demonstration programs for advanced nuclear fuel cycles using plutonium. They already possess sizeable quantities of separated plutonium. Our policy does not endorse or encourage the spread of reprocessing and plutonium; it recognizes that major programs already exist and that we must work realistically with our most important allies to ensure vigorous safeguards and controls over sensitive technology and materials, and to otherwise advance our non-proliferation objectives.

This policy acknowledges that our close allies with advanced nuclear programs which pose no proliferation risk must be distinguished from others. Such a distinction is based upon genuine differences between countries, and we need to tailor our policies to deal with those differences. Past efforts to challenge the carefully considered programs of Japan and EURATOM countries led only to rancorous debates which soured our relations with key allies without enhancing our non-proliferation goals. At the same time we must and we will continue to hold the line against the spread of sensitive nuclear activities particularly where the danger of proliferation demands.

Moreover, our approach would not entail a blanket endorsement of the programs of Japan and EURATOM. We will grant advance consent for reprocessing and the use of plutonium only for those facilities and activities which we can determine satisfy the strict criteria contained in the Atomic Energy Act of 1954, as amended. We are offering this approach in the context of seeking new or amended agreements and the law requires that the President must "determine in writing that the proposed agreement will promote, and will not constitute an unreasonable risk to the common defense and security." In addition, since the advance consent arrangement involves reprocessing, we will also determine before entering into the arrangement that our approval will not result in a significant increase of the risk of proliferation, as would be required under Section 131 of the Act.

In making that determination foremost consideration will be given to whether or not the reprocessing will take place under conditions that will ensure timely warning to the U.S. of any diversion.

For other countries with which we have cooperation agreements, we will be working to provide advance, long-term consent for retransfers of U.S.-origin spent fuel to the United Kingdom and France for reprocessing in facilities which meet the applicable statutory criteria. Disposition of the recovered plutonium would be subject to further US consent. Such arrangements will also be made in the context of seeking new or amended peaceful nuclear cooperation agreements.

During the past two administrations, requests for reprocessing or retransfer of plutonium were approved on a case-by-case basis. Past approvals have involved primarily reprocessing in Japan at Tokai Mura or the shipment of spent fuel from Japan and a few other countries to France and the UK for reprocessing. Both previous administrations and this administration have always approved such requests. However, the case-by-case approach was resented by these countries because it caused considerable uncertainty in their nuclear power planning.

The previous Administration was considering ways to reduce that uncertainty during its last year in office and was consulting with our key allies on possible approaches including the provision of more extended approvals. Our approach is thus not a major break with past practices but a logical progression from them. It is also consistent with the approaches recently adopted toward Japan and EURATOM by Canada and Australia which presently insist as a general policy on consent rights similar to ours.

Our approach includes as well an effort to strengthen our agreements for cooperation, safeguards and other controls on civil plutonium. As you know, the present agreements between the U.S. and EURATOM do not provide for U.S. consent rights over the reprocessing of nuclear material which we export to the Community. We are required by the Nuclear Non-Proliferation Act of 1978 (NNPA) to seek such consent rights in EURATOM and to expand the ones we have presently with Japan. The countries of EURATOM are not likely to give the U.S. such rights nor is Japan likely to agree to expanding existing ones unless they are confident that we will exercise those rights in a responsible and predictable manner. I believe our new approach will go a long way toward convincing these countries that their agreement to new or expanded consent rights will place our nuclear relations on a more sound and orderly basis.

In addition, advance, long-term approval of reprocessing with EURATOM and Japan is clearly premised on the expectation of strengthened and broadened cooperation on non-proliferation matters, particularly in dealing with pressing proliferation problems in sensitive regions of the world and in implementing more effective controls on civil plutonium. Such approvals would be premised on continued commitments to improve the application of IAEA safeguards at reprocessing plants and other facilities which process, use or store plutonium as well as commitments to assure adequate physical security measures for plutonium.

Such cooperation from the major advanced nuclear countries is essential if we are to succeed in strengthening these aspects of the non-proliferation regime. The US no longer enjoys a position as the monopoly supplier of nuclear materials equipment and technology. Today we supply only some 35% of the non-communist enrichment market whereas we accounted for virtually all of it just a few years ago. But if we are to have the full cooperation of the other advanced nuclear powers in pursuing our non-proliferation objectives, we cannot continue to press a policy which is hostile to their reprocessing and breeder programs or which needlessly creates uncertainties and difficulties for their nuclear power planning affecting capital investments in the billions of dollars. In that kind of atmosphere, U.S.

proposals to modify the design features of those facilities to strengthen the application of safeguards and other steps to ensure more vigorous controls on the use of plutonium would be viewed with skepticism, if not as an effort to undermine foreign reprocessing and breeder programs. It is, therefore, essential that we take steps to remove the tensions that have marred our nuclear relations with our close allies over the past few years so that we can work more effectively together.

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Treaty on the Non-Proliferation of Nuclear Weapons

Statement on the 15th Anniversary of the Treaty. July 1, 1983

Fifteen years ago today, the United States, the Soviet Union, the United Kingdom, and 58 other nations signed the Treaty on the Non-Proliferation of Nuclear Weapons (NPT). This treaty, now with 119 parties, has the widest adherence of any arms control treaty in history. Both NATO and Warsaw Pact countries, nuclear-weapon states and nonnuclear-weapon states, developed and developing countries, and countries from every region of the globe have committed themselves to the NPT and its objectives.

Nuclear-weapon states party to this treaty have agreed not to assist nonnuclear-weapon states to acquire nuclear explosives, and nonnuclear-weapon states have pledged not to acquire nuclear explosives. These mutual pledges recognize that the further spread of nuclear weapons threatens all nations.

The NPT also calls for parties to assist in the development of the peaceful uses of nuclear energy, especially in nonnuclear-weapon states which are parties to the treaty. The peaceful uses of nuclear energy are important to the well-being of many other peoples, and the United States takes its obligations for cooperation in this area seriously. We have long been in the forefront of those providing technical assistance and other cooperation in the nuclear field, and we are committed to continuing such cooperation under adequate safeguards.

The United States also recognizes its obligation under the NPT to pursue negotiations in good faith on effective measures relating to nuclear disarmament. This is an issue of major concern to all countries. I am personally committed to take whatever steps are necessary to increase the likelihood of real, substantive progress towards an agreement involving significant reductions in U.S. and Soviet strategic nuclear arsenals to equal more stable levels and that would be in the national security interests of both sides. The United States will also spare no effort to negotiate an equitable and verifiable agreement on intermediate-range nuclear forces that would reduce the risk of war in Europe and globally.

The United States played a major role in the negotiation of the NPT, and five U.S. Presidents over its lifetime have strongly supported the treaty as a cornerstone of the international effort to prevent the spread of nuclear explosives to additional countries. As we plan for the important NPT Review Conference in 1985, the United States will continue to strive to strengthen the viability of this treaty. I urge all countries that have not yet done so to join the growing consensus against the spread of nuclear explosives by adhering to the NPT.

In July 1981, I outlined a policy to prevent the proliferation of nuclear explosives, and declared that this issue was critical to future international peace and regional and global stability. But if we are to succeed in halting the spread of nuclear weapons, the nations of the world must work together. As I have announced on previous occasions, one key step would be for nuclear suppliers to agree on requiring comprehensive safeguards as a condition for any significant new nuclear supply commitment. This is not a policy that denies nuclear assistance, but rather one that conditions assistance on a reasonable demonstration that a nonnuclear-weapon state's entire program is dedicated to the peaceful use of nuclear energy. This demonstration has already been made by the 116 nonnuclear-weapon states that are parties to the NPT. It is my hope that agreement can be reached soon on this measure to strengthen the international nonproliferation regime.

On this the 15th anniversary of the opening of the NPT for signature, all states should rededicate themselves to achieving the purposes of this important treaty and to ensuring its continued vitality. That is both our shared responsibility and a contribution to peace for future generations.

Source: Weekly Compilation of Presidential Documents. July 11. 1983: 971-972.

(3) Executive Order 10841, September 30, 1959, 24 F.R. 7941, 3 CFR 1959–63 Comp., p. 375; as amended by Executive Order 10956, August 12, 1961, 26 F.R. 7315, 3 CFR 1959–63 Comp., p. 482

PROVIDING FOR THE CARRYING OUT OF CERTAIN PROVISIONS OF THE ATOMIC ENERGY ACT OF 1954, AS AMENDED, RELATING TO INTERNATIONAL COOPERATION

By virtue of the authority vested in me by the Atomic Energy Act of 1954, as amended (42 U.S.C. 2011 et seq.), herein referred to as the Act, and section 301 of title 3 of the United States Code, and as President of the United States, it is ordered as follows:

Section 1. Whenever the President, pursuant to section 123 of the Act, has approved and authorized the execution of a proposed agreement providing for cooperation pursuant to section 91c, 144a, 144b, or 144c of the Act (42 U.S.C. 2121(c), 2164(a), 2164(c)), such approval and authorization by the President shall constitute his authorization to cooperate to the extent provided for in the agreement and in the manner provided for in section 91c, 144a, 144b, or 144c, as pertinent. In respect of sections 91c, 144b, and 144c, authorizations by the President to cooperate shall be subject to the requirements of section 123d of the Act and shall also be subjected to appropriate determinations made pursuant to section 2 of this order.

Sec. 2. (a) The Secretary of Defense and the Atomic Energy Commission are hereby designated and empowered to exercise jointly, after consultation with executive agencies as may be appropriate, the following described authority without the approval, ratification, or other action of the President:

(1) The authority vested in the President by section 91c of the Act to determine that the proposed cooperation and each proposed transfer arrangement referred to in that section will promote and will not constitute an unreasonable risk to the common defense and security.

(2) The authority vested in the President by section 144b of the Act to determine that the proposed cooperation and the proposed communication of Restricted Data referred to in that section will promote and will not constitute an unreasonable risk to the common defense and security: *Provided*, That each determination made under this paragraph shall be referred to the President and, unless disapproved by him, shall become effective fifteen days after such referral or at such later time as may be specified in the determination.[1]

(3) The authority vested in the President by section 144c of the Act to determine that the proposed cooperation and the

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[1] This provision was added by Executive Order 10956, Aug. 12, 1961, 26 F.R. 7315.

communication of the proposed Restricted Data referred to in that section will promote and will not constitute an unreasonable risk to the common defense and security.

(b) Whenever the Secretary of Defense and the Atomic Energy Commission are unable to agree upon a joint determination under the provisions of subsection (a) of this section, the recommendations of each of them, together with the recommendations of other agencies concerned, shall be referred to the President, and the determination shall be made by the President.

Sec. 3. This order shall not be construed as delegating the function vested in the President by section 91c of the Act of approving programs proposed under that section.

Sec. 4. (a) The functions of negotiating and entering into international agreements under the Act shall be performed by or under the authority of the Secretary of State.

(b) International cooperation under the Act shall be subject to the responsibilities of the Secretary of State with respect to the foreign policy of the United States pertinent thereto.

Executive Order 11057, October 18, 1962, 27 F.R. 10289

AUTHORIZATION FOR THE COMMUNICATION OF RESTRICTED DATA BY THE DEPARTMENT OF STATE

By virtue of the authority vested in me by the Atomic Energy Act of 1954, as amended (hereinafter referred to as the Act; 42 U.S.C. 2011 et seq.), and as President of the United States, it is ordered as follows:

The Department of State is hereby authorized to communicate, in accordance with the terms and conditions of any agreement for cooperation arranged pursuant to subsection 144b of the Act (42 U.S.C. 2164(b)), such Restricted Data and data removed from the Restricted Data category under subsection 142d of the Act (42 U.S.C. 2162(d)) as is determined

> "(i) by the President, pursuant to the provisions of the Act, or (ii) by the Atomic Energy Commission [1] and the Department of Defense, jointly pursuant to the provisions of Executive Order No. 10841, as amended,

to be transmissible under the agreement for cooperation involved. Such communications shall be effected through mechanisms established by the Department of State in accordance with the terms and conditions of the agreement for cooperation involved: *Provided*, That no such communication shall be made by the Department of State until the proposed communication has been authorized either in accordance with procedures, adopted by the Atomic Energy Commission [1] and the Department of Defense and applicable to conduct of programs for cooperation by those agencies, or in accordance with procedures approved by the Atomic Energy Commission [1] and the Department of Defense and applicable to conduct of programs for cooperation by the Department of State.

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[1] Functions of the Atomic Energy Commission under this Executive order were modified so that such functions would be exercised by the Secretary of Energy and the Nuclear Regulatory Commission, pursuant to sec. 4(a)(1) of Executive Order 12038, Feb. 3, 1978, 43 F.R. 4957.

No. 11902

Feb. 2, 1976, 41 F.R. 4877

PROCEDURES FOR AN EXPORT LICENSING POLICY AS TO NUCLEAR MATERIALS AND EQUIPMENT

The Energy Reorganization Act of 1974 transferred to the United States Nuclear Regulatory Commission the licensing and related regulatory functions previously exercised by the Atomic Energy Commission under the Atomic Energy Act of 1954, as amended.

The exercise of discretion and control over nuclear exports within the limits of law concerns the authority and responsibility of the President with respect to the conduct of foreign policy and the ensuring of the common defense and security.

It is essential that the Executive branch inform the Nuclear Regulatory Commission of its views before the Commission issues or denies a license, or grants an exemption.

NOW, THEREFORE, by virtue of the authority vested in me by the Constitution and statutes of the United States of America, including the Atomic Energy Act of 1954, as amended (42 U.S.C. 2011 et seq.), and as President of the United States of America, it is hereby ordered as follows:

Section 1. (a) The Secretary of State is designated to receive from the Nuclear Regulatory Commission a copy of each export license application, each proposal by the Nuclear Regulatory Commission to issue a general license for export, and each proposal by the Nuclear Regulatory Commission for exemption from the requirement for a license, which may involve a determination, pursuant to the Atomic Energy Act of 1954, as amended, that the issuance of the license or exemption from the requirement for a license will, or will not, be inimical to or constitute an unreasonable risk to the common defense and security.

(b) The Secretary of State shall ensure that a copy of each such application, proposed general license, or proposed exemption is received by the Secretary of Defense, the Secretary of Commerce, the Administrator of the United States Energy Research and Development Administration, hereinafter referred to as the Administrator, the Director of the Arms Control and Disarmament Agency, hereinafter referred to as the Director, and the head of any other department or agency which may have an interest therein, in order to afford them the opportunity to express their views, if any, on whether the license should be issued or the exemption granted.

Sec. 2. Within thirty days of receipt of a copy of a license application, proposed general license, or proposed exemption, the Secretary of Defense, the Secretary of Commerce, the Administrator, the Director, and the head of any other agency or department to which such copy has been transmitted, shall each transmit to the Secretary of State his views, if any, on whether and under what conditions the license should be issued or the exemption granted.

Sec. 3. The Secretary of State shall, after the provisions of section 2 of this order have been complied with, transmit to the Secretary of Defense, the Secretary of Commerce, the Administrator, the Director, and the head of any other department or agency who has expressed his views thereon, a proposed position of the Executive branch as to whether the license should be issued or the exemption granted, including a proposed judgment as to whether issuance of the license or granting of the exemption will, or will not, be inimical to or constitute an unreasonable risk to the common defense and security.

Sec. 4. If the heads of departments and agencies specified in section 2 of this order are unable to agree upon a position for the Executive branch, the Secretary of State shall refer the matter to the Chairman of the Under Secretaries Committee of the National Security Council in order to obtain a decision. In the event the Under Secretaries Committee is unable to reach a decision, the Chairman of that Committee shall refer the matter to the President for his decision.

Sec. 5. The Secretary of State, after taking the actions required by this order, shall notify the Nuclear Regulatory Commission of the position of the Executive branch as to whether the license should be issued or the exemption granted, including the judgment of the Executive branch as to whether issuance of the license or granting of the exemption will, or will not, be inimical to or constitute an unreasonable risk to the common defense and security. The Executive branch position shall be supported by relevant information and documentation as appropriate to the proceedings before the Nuclear Regulatory Commission.

GERALD R. FORD

THE WHITE HOUSE,
February 2, 1976.

Executive Order 12055, April 27, 1978, 43 F.R. 18157

EXPORT OF SPECIAL NUCLEAR MATERIAL TO INDIA

By virtue of the authority vested in me as President by the Constitution of the United States of America and by Section 126b(2) of the Atomic Energy Act of 1954 (42 U.S.C. 2155), as amended by Section 304(a) of the Nuclear Non-Proliferation Act of 1978 (Public Law 95–242, 92 Stat. 131), and having determined that withholding the export proposed pursuant to Nuclear Regulatory Commission export license application XSNM–1060 would be seriously prejudicial to the achievement of the United States non-proliferation objectives, that export to India is authorized; however, such export shall not occur for a period of 60 days as defined by Section 130g of the Atomic Energy Act of 1954, as amended

Executive Order 12058, May 11, 1978, 43 F.R. 20947

FUNCTIONS RELATING TO NUCLEAR NON-PROLIFERATION

By virtue of the authority vested in me by the Nuclear Non-Proliferation Act of 1978 (Public Law 95-242, 92 Stat. 120, 22 U.S.C. 3201) and the Atomic Energy Act of 1954, as amended (42 U.S.C. 2011 et seq.), and Section 301 of Title 3 of the United States Code, and as President of the United States of America, it is hereby ordered as follows:

Section 1. Department of Energy. The following functions vested in the President by the Nuclear Non-Proliferation Act of 1978 (92 Stat. 120, 22 U.S.C. 3201), hereinafter referred to as the Act, and by the Atomic Energy Act of 1954, as amended (42 U.S.C. 2011 et seq.), hereinafter referred to as the 1954 Act, are delegated or assigned to the Secretary of Energy:

(a) That function vested by Section 402(b) of the Act (92 Stat. 145, 42 U.S.C. 2153a).

(b) Those functions vested by Sections 131a(2)(G), 131b(1), and 131f(2) of the 1954 Act (92 Stat. 127, 42 U.S.C. 2160).

(c) That function vested by Section 131f(1)(A)(ii) of the 1954 Act to the extent it relates to the preparation of a detailed generic plan.

Sec. 2. Department of State. The Secretary of State shall be responsible for performing the following functions vested in the President:

(a) Those functions vested by Sections 104(a), 104(d), 105, 4[illegible], 404, 407, and 501 of the Act (92 Stat. 122, 123, 146, 147, and 22 U.S.C. 3223(a), 3223(d), 3224, and 42 U.S.C. 2153b, 2153c, 2153e, and 22 U.S.C. 3261).

(b) That function vested by Section 128a(2) of the 1954 Act (92 Stat. 137, 42 U.S.C. 2157(a)(2)).

(c) That function vested by Section 601 of the Act to the extent it relates to the preparation of an annual report.

(d) The preparation of timely information and recommendations related to the President's functions vested by Sections 126, 128b, and 129 of the 1954 Act (92 Stat. 131, 137, and 138, 42 U.S.C. 2155, 2157, and 2158).

(e) That function vested by Section 131c of the 1954 Act (92 Stat. 129, 42 U.S.C. 2160(c)); except that, the Secretary shall not waive the 60-day requirement for the preparation of a Nuclear Non-Proliferation Assessment Statement for more than 60 days without the approval of the President.

Sec. 3. Department of Commerce. The Secretary of Commerce shall be responsible for performing the function vested in the President by Section 309(c) of the Act (92 Stat. 141, 42 U.S.C. 2139a).

Sec. 4. Coordination. In performing the functions assigned to them by this Order, the Secretary of Energy and the Secretary of

State shall consult and coordinate their actions with each other and with the heads of other concerned agencies.

Sec. 5. General Provisions. (a) Executive Order No. 11902 of February 2, 1976, entitled "Procures for an Export Licensing Policy as to Nuclear Materials and Equipment," is revoked.

(b) The performance of functions under either the Act or the 1954 Act shall not be delayed pending the development of procedures, even though as many as 120 days are allowed for establishing them. Except where it would be inconsistent to do so, such functions shall be carried out in accordance with procedures similar to those in effect immediately prior to the effective date of the Act.

Executive Order 12409, March 7, 1983, 48 F.R. 9829

Nuclear Cooperation With EURATOM

By the authority vested in me as President by the Constitution and statutes of the United States of America, including section 126a(2) of the Atomic Energy Act of 1954, as amended (42 U.S.C. 2155a(2)), and having determined that, upon the expiration of the period specified in the first proviso to section 126a(2) of such Act and extended by Executive Orders No. 12193, 12295, and 12351, failure to continue peaceful nuclear cooperation with the European Atomic Energy Community would be seriously prejudicial to the achievement of the United States nonproliferation objectives and would otherwise jeopardize the common defense and security of the United States, and having notified the Congress of this determination, I hereby extend the duration of that period to March 10, 1984.

Executive Order 12218, June 19, 1980, 45 F.R. 41625

EXPORT OF SPECIAL NUCLEAR MATERIAL AND COMPONENTS TO INDIA

By the authority vested in me as President by the Constitution and statutes of the United States of America, including Section 126b. (2) of the Atomic Energy Act of 1954, as amended (42 U.S.C. 2155(b)(2)), and having determined that withholding the exports proposed pursuant to Nuclear Regulatory Commission export license applications XSNM-1379, XSNM-1569, XCOM-0240, XCOM-0250, XCOM-0376, XCOM-0381 and XCOM-0395, would be seriously prejudicial to the achievement of United States non-proliferation objectives and would otherwise jeopardize the common defense and security, those exports to India are authorized; however, such exports shall not occur for a period of 60 days as defined by Section 130 g. of the Atomic Energy Act of 1954, as amended (42 U.S.C. 2159(g)).

Executive Order 12295 of February 24, 1981

Nuclear Cooperation With EURATOM

46 F.R. 14113

By the authority vested in me as President by the Constitution and statutes of the United States of America, including Section 126a(2) of the Atomic Energy Act of 1954, as amended (42 U.S.C. 2155(a)(2)), and having determined that, upon the expiration of the period specified in the first proviso to Section 126a(2) of such Act and extended by Executive Order 12193,[19] failure to continue peaceful nuclear cooperation with the European Atomic Energy Community would be seriously prejudicial to the achievement of United States non-proliferation objectives and would otherwise jeopardize the common defense and security of the United States, and having notified the Congress of this determination, I hereby extend the duration of that period to March 10, 1982.

Executive Order 12351 of March 9, 1982

Nuclear Cooperation With EURATOM

47 F.R. 10585

By the authority vested in me as President by the Constitution and statutes of the United States of America, including Section 126a(2) of the Atomic Energy Act of 1954, as amended (42 U.S.C. 2155(a)(2)), and having determined that, upon the expiration of the period specified in the first proviso to Section 126a(2) of such Act and extended by Executive Orders No. 12193 and No. 12295, failure to continue peaceful nuclear cooperation with the European Atomic Energy Community would be seriously prejudicial to the achievement of United States nonproliferation objectives and would otherwise jeopardize the common defense and security of the United States, and having notified the Congress of this determination, I hereby extend the duration of that period to March 10, 1983.

Executive Order 12463 of February 23, 1984

Nuclear Cooperation With EURATOM

By the authority vested in me as President by the Constitution and statutes of the United States of America, including Section 126a(2) of the Atomic Energy Act of 1954, as amended (42 U.S.C. 2155(a)(2)), and having determined that, upon the expiration of the period specified in the first proviso to Section 126a(2) of such Act and extended by Executive Order Nos. 12193, 12295, 12351 and 12409, failure to continue peaceful nuclear cooperation with the European Atomic Energy Community would be seriously prejudicial to the achievement of the United States non-proliferation objectives and would otherwise jeopardize the common defense and security of the United States, and having notified the Congress of this determination, I hereby extend the duration of that period to March 10, 1985.

NUCLEAR WEAPONS

CONTENTS

Page

Introduction 269

General principles of nuclear explosions. (Glasstone, 1962), (excerpt) 270

General characteristics of nuclear explosions. (United Nations, 1968), (excerpt) 282

Equivalents of 1 kiloton of TNT. (Glasstone, 1962) 294

Fast critical masses of fissile materials for nuclear explosives. (Hildenbrand, 1977) 295

List of first nuclear explosions. (SIPRI, 1979) 296

Nuclear explosions, 1945–1983 (known and presumed.) (SIPRI, 1984) 297

NUCLEAR WEAPONS

INTRODUCTION

The unprecedented destructive power of nuclear weapons provides good reason to avoid their spread to additional countries. Even relatively small and crude nuclear explosives can release energy equivalent to the explosion of hundreds of tons of TNT, while the largest have yields of millions of tons of TNT. Nuclear explosives produce blast, heat, radiation, and intensely radioactive debris, or fallout. Recent studies suggest that the explosion of many nuclear weapons might cause catastrophic climatic changes, and it is quite possible that some severe effects of nuclear weapons remain unknown.

GENERAL PRINCIPLES OF NUCLEAR EXPLOSIONS

CHARACTERISTICS OF NUCLEAR EXPLOSIONS

INTRODUCTION

1.01 An explosion, in general, results from the very rapid release of a large amount of energy within a limited space. This is true for a conventional "high explosive," such as TNT, as well as for a nuclear (or atomic) explosion,[1] although the energy is produced in quite different ways (§ 1.10). The sudden liberation of energy causes a considerable increase of temperature and pressure, so that all the materials present are converted into hot, compressed gases. Since these gases are at very high temperatures and pressures, they expand rapidly and thus initiate a pressure wave, called a "shock wave," in the surrounding medium—air, water, or earth. The characteristic of a shock wave is that there is a sudden increase of pressure at the front, with a gradual decrease behind it, as shown in Fig. 1.01. A shock wave in air is generally referred to as a "blast wave" because it resembles and is accompanied by a very strong wind. In water or in the ground, however, the term "shock" is used, because the effect is like that of a sudden impact.

1.02 Nuclear weapons are similar to those of more conventional types in so far as their destructive action is due mainly to blast or shock. On the other hand, there are several basic differences between nuclear and high-explosive weapons. In the first place, nuclear explosions can be many thousands (or millions) of times more powerful than the largest conventional detonations. Second, a fairly large proportion of the energy in a nuclear explosion is emitted in the form of light and heat, generally referred to as "thermal radiation." It is capable of causing skin burns and of starting fires at considerable

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[1] The terms "nuclear" and "atomic" may be used interchangeably so far as such weapons and explosions are concerned, but "nuclear" is preferred for the reason given in § 1.10.

Source: Samuel Glasstone, The Effects of Nuclear Weapons. United States Department of Defense, 1962, pp. 1-12.

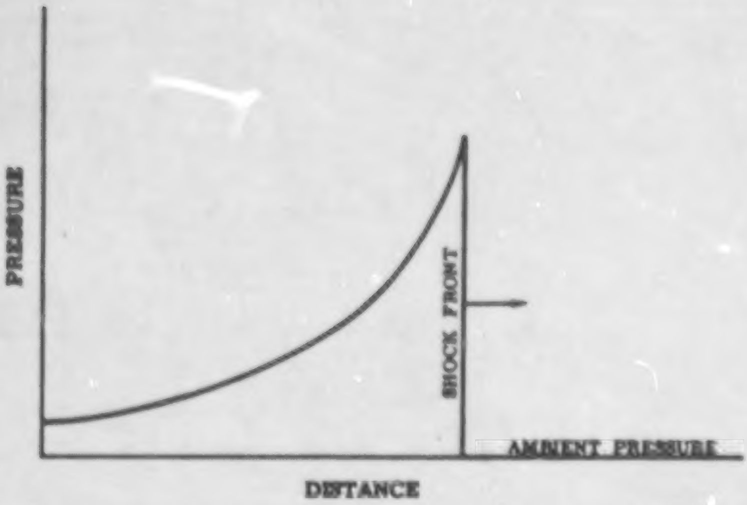


Figure 1.01. Variation of pressure (in excess of ambient) with distance in a shock wave.

distances. Third, the nuclear explosion is accompanied by highly-penetrating and harmful invisible rays, called the "initial nuclear radiation." Finally, the substances remaining after a nuclear explosion are radioactive, emitting similar radiations over an extended period of time. This is known as the "residual nuclear radiation" or "residual radioactivity" (Fig. 1.02).

1.03 It is because of these fundamental differences between a nuclear and a conventional explosion, including the tremendously greater power of the former, that the effects of nuclear weapons require special consideration. In this connection, a knowledge and understanding of the mechanical and the various radiation phenomena associated with a nuclear explosion are of vital importance.

1.04 The purpose of this book is to describe the different forms in which the energy of a nuclear explosion are released, to explain how they are propagated, and to show how they may affect men and materials. Where numerical values are given for specific observed effects, it should be kept in mind that there are inevitable uncertainties associated with the data, for at least two reasons. In the first place, there are inherent difficulties in making exact measurements of weapons effects. The results are often dependent on circumstances which are difficult, if not impossible, to control, even in a test and

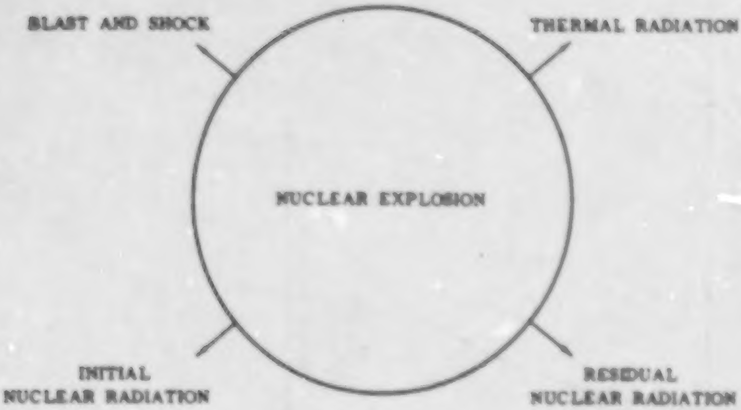


Figure 1.02. Effects of a nuclear explosion.

certainly cannot be predicted in the event of an attack. Furthermore, two weapons having the same yield of explosive energy may have different quantitative effects because of differences in composition and design.

1.05 It is hoped, nevertheless, that the information contained in this volume, which is the best available, may be of assistance to those responsible for defense planning and in making preparations to deal with the emergencies that may arise from nuclear warfare. In addition, architects and engineers may be able to utilize the data in the design of structures having increased resistance to damage by blast, shock, and fire, and which provide shielding against nuclear radiations.

Atomic Structure and Isotopes

1.06 All substances are made up from one or more of about 90 different kinds of simple materials known as "elements." Among the common elements are the gases hydrogen, oxygen, and nitrogen; the solid nonmetals carbon, sulfur, and phosphorus; and various metals, such as iron, copper, and zinc. A less familiar element, which has attained prominence in recent years because of its use as a source of atomic (or nuclear) energy, is uranium, normally a solid metal.

1.07 The smallest part of any element that can exist, while still retaining the characteristics of the element, is called an "atom" of that element. Thus, there are atoms of hydrogen, of iron, of uranium, and so on, for all the elements. The hydrogen atom is the lightest of all atoms, whereas the atoms of uranium are the heaviest of those found in nature. Heavier atoms, such as those of plutonium, also important for the release of atomic energy, have been made artificially from uranium.

1.08 Every atom consists of a relatively heavy central region or "nucleus," surrounded by a number of very light particles known as "electrons." Further, the atomic nucleus is itself made up of a definite number of fundamental particles, referred to as "protons" and "neutrons." These two particles have almost the same mass, but they differ in the respect that the proton carries a unit charge of positive electricity whereas the neutron, as its name implies, is uncharged electrically, i.e., it is neutral. Because of the protons present in the nucleus, the latter has a positive electrical charge, but in the normal atom this is exactly balanced by the negative charge carried by the electrons surrounding the nucleus.

1.09 The essential difference between atoms of different elements lies in the number of protons (or positive charges) in the nucleus; this is called the "atomic number" of the element. Hydrogen atoms, for example, contain only one proton, helium atoms have two protons, uranium atoms have 92 protons, and plutonium atoms 94 protons. Although all the nuclei of a given element contain the same number of protons, they may have different numbers of neutrons. The resulting atomic species, which have identical atomic numbers but which differ in their masses, are called "isotopes" of the particular element. All but about 20 of the elements occur in nature in two or more isotopic forms, and many other isotopes, which are unstable, i.e., radioactive, have been obtained in various ways.

RELEASE OF NUCLEAR ENERGY: FISSION AND FUSION REACTIONS

1.10 As stated in § 1.01, an explosion is caused by the very rapid release of a large amount of energy. In the case of a conventional explosion, this energy arises from chemical reactions; these involve a rearrangement among the atoms, e.g., of hydrogen, carbon, oxygen, and nitrogen, present in the chemical high-explosive material. In a nuclear explosion, on the other hand, the energy is produced as a result of the formation of different atomic nuclei by the redistribution of the protons and neutrons within the interacting nuclei. What is commonly referred to as atomic energy is thus, strictly, nuclear energy, since it results from particular nuclear interactions. It is for the same reason, too, that atomic weapons are preferably called "nuclear weapons." The forces between the protons and neutrons within atomic nuclei are tremendously greater than those between the atoms; consequently, nuclear energy is of a much higher order of magnitude than conventional (or chemical) energy when equal masses are considered.

1.11 Many nuclear processes are known, but not all of these are accompanied by the release of energy. There is a definite equivalence between mass and energy, and when a decrease of mass occurs in a nuclear reaction there is an accompanying release of a certain amount of energy related to the decrease in mass. These mass changes are really a reflection of the difference in the forces in the various nuclei. It is a basic law of nature that the conversion of any system in which the constituents are held together by weaker forces into one in which the forces are stronger must be accompanied by the release of energy, and a corresponding decrease in mass.

1.12 In addition to the necessity for the nuclear process to be one in which there is a net decrease in mass, the release of nuclear energy in amounts sufficient to cause an explosion requires that the reaction should be able to reproduce itself once it has been started. Two kinds of nuclear interactions can satisfy the conditions for the production of large amounts of energy in a short time. They are known as "fission" and "fusion." The former process takes place with some of the heaviest (high atomic number) nuclei, whereas the latter, at the other extreme, involves some of the lightest (low atomic number) nuclei.

1.13 The materials used to produce nuclear explosions by fission are certain isotopes of the elements uranium and plutonium. Uranium as found in nature consists of two isotopes, namely uranium-235 and uranium-238; the former, which is by far the less abundant, is the readily fissionable species used in nuclear weapons. The element plutonium does not occur naturally, and the fissionable isotope plutonium-239 is made artificially. When a free (or unattached) neutron enters the nucleus of a fissionable atom, it can cause the nucleus to split into two smaller parts. This is the fission process, which is accompanied by the release of a large amount of energy. The smaller (or lighter) nuclei which result are called the "fission products." The complete fission of 1 pound of uranium or of plutonium releases as much energy as the explosion of 8,000 tons of TNT.

1.14 In nuclear fusion, a pair of light nuclei unite (or fuse) together, to form a nucleus of a heavier atom. An example is the fusion of the hydrogen isotope known as deuterium or "heavy hydrogen." Under suitable conditions, two deuterium nuclei may combine to form the nucleus of a heavier element, helium, with the release of energy.

1.15 Nuclear fusion reactions can be brought about by means of very high temperatures, and they are thus referred to as "thermonuclear processes." The actual quantity of energy liberated, for a given mass of material, depends on the particular isotope (or isotopes) involved in the nuclear fusion reaction. As an example, the fusion of all the nuclei present in 1 pound of the hydrogen isotope deuterium would release roughly the same amount of energy as the explosion of 26,000 tons of TNT.

1.16 In certain fusion processes, among nuclei of the hydrogen isotopes, neutrons of high energy are liberated (see § 1.68). These can cause fission in the most abundant isotope (uranium-238) in ordinary uranium as well as in uranium-235. Consequently, association of the appropriate fusion reactions with natural uranium can result in an extensive utilization of the latter for the release of energy. A device in which fission and fusion (thermonuclear) reactions are combined can therefore produce an explosion of great power. On the average, in weapons of this type, roughly equal amounts of explosive energy result from fission and from fusion.

1.17 A distinction is sometimes made between atomic weapons in which the energy arises from fission, on the one hand, and hydrogen (or thermonuclear) weapons, involving fusion, on the other hand. In each case, however, the explosive energy results from nuclear reactions, so that they may both be correctly described as nuclear (or atomic) weapons. In this book, therefore, the general terms "nuclear bomb" and "nuclear weapon" will be used, irrespective of the type of nuclear reaction producing the energy of the explosion.

ENERGY YIELD OF A NUCLEAR EXPLOSION

1.18 The power of a nuclear weapon is expressed in terms of the energy release (or yield) when it explodes compared with the energy liberated by the explosion of TNT. Thus, a 1-kiloton nuclear weapon is one which produces the same amount of energy in an explosion as does 1 kiloton (or 1,000 tons) of TNT. Similarly, a 1-megaton weapon would have the energy equivalent of 1 million tons (or 1,000 kilotons) of TNT. The earliest nuclear bombs, such as those dropped over Japan in 1945, and those used in the tests at Bikini in 1946, released roughly the same quantity of energy as 20,000 tons (or 20 kilotons) of TNT. Since that time, much more powerful weapons, with energy yields in the megaton range, have been developed.

1.19 From the statement in § 1.13 that the fission of 1 pound of uranium or plutonium will release the same amount of energy as

8,000 tons of TNT, it is evident that in a 20-kiloton nuclear weapon 2.5 pounds of material undergo fission. However, the actual weight of uranium or plutonium in such a weapon is greater than this amount. In other words, in a fission weapon, only part of the nuclear material suffers fission. The efficiency is thus said to be less than 100 percent.

THERMAL RADIATION

1.20 It has been mentioned that one important difference between nuclear and conventional (or chemical) explosions is the appearance of an appreciable proportion of the energy as thermal radiation in the former case. The basic reason for this difference is that, weight for weight, the energy produced in a nuclear explosion is millions of times as great as that in a chemical explosion. Consequently, the temperatures reached in the former case are much higher than in the latter, namely, tens of millions of degrees in a nuclear explosion compared with a few thousands in a conventional explosion. As a result of this great difference in temperature, the distribution of the explosion energy is quite different in the two cases.

1.21 Broadly speaking, the energy may be divided into three categories: kinetic (or external) energy, i.e., energy of motion of electrons, atoms, and molecules as a whole; internal energy of these particles; and thermal radiation energy. The proportion of thermal energy increases rapidly with increasing temperature. At the moderate temperatures attained in a chemical explosion, the amount of thermal radiation is comparatively small, and so essentially all the energy released at the time of the explosion appears as kinetic and internal energy. This is almost entirely converted into blast and shock, in the manner described in § 1.01. Because of the very much higher temperatures in a nuclear explosion, however, a considerable proportion of the energy released is present as thermal radiation which is ultimately emitted as intense heat and light rays. The manner in which this takes place is described later (§ 1.73 *et seq.*). Blast and shock are also produced as in a conventional explosion.

DISTRIBUTION OF ENERGY IN NUCLEAR EXPLOSIONS

1.22 The fraction of the explosion yield received as thermal energy at a distance from the burst point depends on the nature of the weapon and particularly on the environment of the explosion. For a detonation in the atmosphere below an altitude of about 100,000 feet, it ranges from about 30 to 40 percent. For purposes of illustration it will be assumed here that 35 percent of the explosion energy is received as thermal energy. In this event, about 50 percent of the fission energy will be utilized in the production of blast and shock (Fig. 1.22). At higher altitudes, where there is less air with which the energy of the exploding weapon can interact, the proportion of the fission energy converted into blast is decreased, whereas the thermal radiation is increased. On the other hand, at the other extreme of a completely confined underground explosion of a nuclear weapon, little or no thermal radiation escapes.

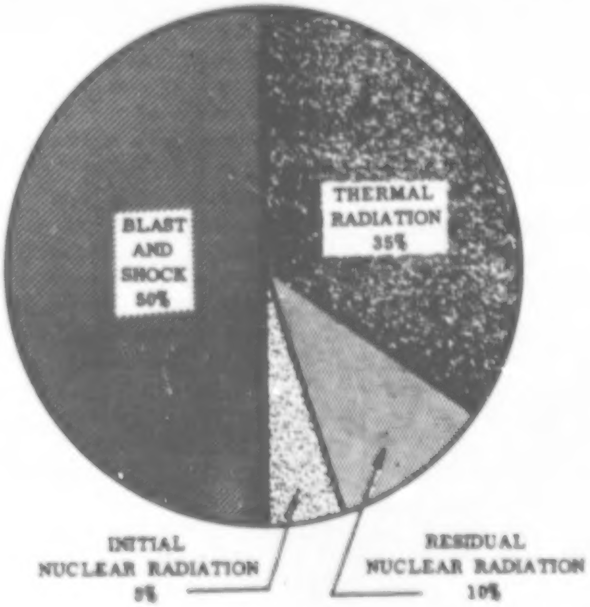


Figure 1.22. Distribution of energy in a typical air burst of a fission weapon in air at an altitude below 100,000 feet.

1.23 In addition to the 85 percent of the fission energy which is converted into blast, shock, and thermal radiation, the remaining 15 percent is released as various nuclear radiations. Of this, some 5 percent constitutes the initial nuclear radiations produced within a minute or so of the explosion. The final 10 percent of the total fission explosion energy represents that of the residual (or delayed) nuclear radiation which is emitted over a period of time. This is due almost entirely to the radioactivity of the fission products present in the weapon residues (or debris) after the explosion. In a thermonuclear device, in which only about half of the total energy arises from fission (§ 1.16), the residual nuclear radiation carries only 5 percent of the energy released in the explosion. It should be noted that there are no nuclear radiations from a conventional explosion since the nuclei are unaffected in the chemical reactions which take place.

1.24 Since about 10 percent of the total fission energy is released in the form of residual nuclear radiation some time after the detonation, this is not included when the energy yield of a nuclear explosion is stated, e.g., in terms of the TNT equivalent as in § 1.18. Hence, in a pure fission weapon the explosion energy is about 90 percent of the total fission energy, and in a thermonuclear device it is, on the average, about 95 percent of the total energy of the fission and fusion reactions.

1.25 The initial nuclear radiations consist mainly of "gamma rays," which are electromagnetic radiations of high energy (see § 1.69) originating in atomic nuclei, and neutrons. These radiations, especially gamma rays, can travel great distances through air and can penetrate considerable thicknesses of material. Although they can neither be seen nor felt by human beings, except in very large doses which produce a tingling sensation, gamma rays and neutrons can produce harmful effects even at a distance from their source. Consequently, the initial nuclear radiations are an important aspect of nuclear explosions.

1.26 The delayed nuclear radiations, as mentioned earlier, arise from the fission products which, in the course of their radioactive decay, emit gamma rays and another type of nuclear radiation called "beta particles." The latter are identical with electrons, i.e., subatomic particles carrying a negative electric charge (§ 1.08), moving with high speed. Beta particles, which are also invisible, are much less penetrating than gamma rays, but like the latter they represent a potential hazard.

1.27 The spontaneous emission of beta particles and gamma rays from radioactive substances, such as the fission products, is a gradual process. It takes place over a period of time, at a rate depending upon the nature of the material and upon the amount present. Because of the continuous decay, the quantity of radioactive material and the rate of emission of radiation decrease steadily. This means that the residual nuclear radiation, due mainly to the fission products, is most intense soon after the explosion but diminishes in the course of time.

TYPES OF NUCLEAR EXPLOSIONS

1.28 The immediate phenomena associated with a nuclear explosion, as well as the effects of shock and blast, and thermal and nuclear radiations, vary with the location of the point of burst in relation to the surface of the earth. For descriptive purposes five types of burst are distinguished, although many variations and intermediate situations can arise in practice. The main types, which will be defined below, are (1) air burst, (2) high-altitude burst, (3) underwater burst, (4) underground burst, and (5) surface burst.

1.29 Almost immediately after a nuclear explosion, the weapon residues incorporate material from the surrounding medium and form an intensely hot and luminous mass, roughly spherical in shape, called the "fireball." An "air burst" is defined as one in which the weapon is exploded in the air at an altitude below 100,000 feet, but at such a height that the fireball (at roughly maximum brilliance in its later stages) does not touch the surface of the earth. For example, in the explosion of a 1-megaton weapon the fireball may grow until it is nearly 5,800 feet (1.1 mile) across at maximum brilliance. This means that, in this particular case, the explosion must occur at least 2,900 feet above the earth's surface if it is to be called an air burst.

1.30 The quantitative aspects of an air burst will be dependent upon the actual height of the explosion, as well as upon its energy yield, but the general phenomena are much the same in all cases. Nearly all of the shock energy appears as air blast, although some is generally also transmitted into the ground. The thermal radiation will travel large distances through the air and will be of sufficient intensity to cause moderately severe burns of exposed skin as far away as 12 miles from a 1-megaton explosion, on a fairly clear day. The warmth may be felt at a distance of 75 miles. For air bursts of higher energy yields, the corresponding distances will, of course, be greater. Since the thermal radiation is largely stopped by ordinary opaque materials, buildings and clothing can provide protection.

1.31 The initial nuclear radiations from an air burst will also penetrate a long way in air, although the intensity falls off fairly rapidly at increasing distances from the explosion. The nuclear radiations are not easily absorbed, and fairly thick layers of materials, preferably of high density, are needed to reduce their intensity to harmless proportions. For example, at a distance of 1 mile from the air burst of a 1-megaton nuclear weapon, an individual would probably need the protection of about 1 foot of steel or 4 feet of concrete to be relatively safe from the effects of the initial nuclear radiations. However, at this distance the blast effect would be so great that only specially designed blast-resistant structures would survive.

1.32 In the event of a high or moderately high air burst, the fission products remaining after the nuclear explosion will be spread out over a large area. The residual nuclear radiations arising from these products will be of minor immediate consequence on the ground. On the other hand, if the burst occurs nearer the earth's surface, the fission products may fuse with particles of earth, part of which will soon fall to the ground at points close to the explosion. This dirt and other debris will be contaminated with radioactive material and will, consequently, represent a possible danger to living organisms.

1.33 A "high-altitude burst" is defined as one in which the explosion takes place at an altitude in excess of 100,000 feet. Above this level, the air density is so low that the interaction of the weapon energy with the surroundings is markedly different from that at lower altitudes and, moreover, varies with the altitude. The absence of relatively dense air causes the fireball characteristics in a high-altitude explosion to differ from those of an air burst. For example, the fraction of the energy of fission converted into blast and shock is less and decreases with increasing altitude. A larger proportion of the explosion energy is then in the form of thermal radiation. It has been estimated that at great heights, where the density of the air is extremely low, more than 50 percent of the fission energy might appear as thermal radiation at some distance from the exploding weapon.

1.34 In contrast to thermal radiation, the fraction of the explosion energy emitted as nuclear radiations is independent of the height of burst. However, the attenuation of the initial nuclear radiations with increasing distance from the explosion is determined by the total amount of air through which the radiation travels. This means that, for a given explosion energy yield, more initial nuclear radiation will be received at the same slant distance on the earth's surface from a high-altitude detonation than from a moderately high air burst. On the other hand, in a high-altitude nuclear explosion the fission products will be widely dispersed in the stratosphere, so that there is no immediate hazard on the surface from the residual nuclear radiations.

1.35 If a nuclear explosion occurs under such conditions that its center is beneath the ground or under the surface of water, the situation is described as an "underground burst" or an "underwater burst," respectively. Since some of the effects of these two types of explosions are similar, they will be considered here together as subsurface bursts. In a subsurface burst, most of the shock energy of the explosion appears as underground or underwater shock, but a certain proportion, which is less the greater the depth of the burst, escapes and produces air blast. Much of the thermal radiation and of the initial nuclear radiations will be absorbed within a short distance of the explosion. The energy of the absorbed radiations will merely contribute to the heating of the ground or body of water. Depending upon the depth of the explosion, some of the thermal and nuclear radiations will escape, but the intensities will be less than for an air burst. However, the residual nuclear radiations now become of considerable significance, since large quantities of earth or water in the vicinity of the explosion will be contaminated with radioactive fission products.

1.36 A "surface burst" is regarded as one which occurs either at or slightly above the actual surface of the land or water. Provided the distance above the surface is not great, the phenomena are essentially the same as for a burst occurring on the surface. As the height of burst increases up to a point where the fireball (at maximum brilliance in its later stages) no longer touches the land or water, there is a transition zone in which the behavior is intermediate between that of a true surface burst and of an air burst. In surface bursts, the air blast and ground (or water) shock are produced in varying proportions depending on the energy of the explosion and the height of burst.

1.37 Although the five types of burst have been considered as being fairly distinct, there is actually no clear line of demarcation between them. It will be apparent that, as the height of the explosion is decreased, a high-altitude burst will become an air burst, and an air burst will become a surface burst. Similarly, a surface burst merges into a subsurface explosion at a shallow depth, when part of the fireball actually breaks through the surface of the land or water. It is nevertheless a matter of convenience, as will be seen in later chapters, to divide nuclear explosions into the five general types defined above.

UNITED NATIONS, 1968

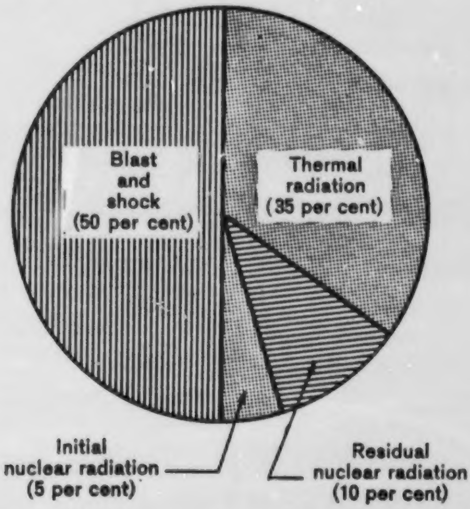
GENERAL CHARACTERISTICS OF NUCLEAR EXPLOSIONS

1. The yield of a nuclear weapon is expressed in terms of the energy released when it is exploded, compared with the energy liberated by the explosion of the chemical explosive trinitrotoluene (TNT). The biggest bombs ever made from conventional explosive contained the equivalent of about 10 tons of TNT. A one-kiloton nuclear weapon produces the same amount of energy as 1,000 tons of TNT. Correspondingly, a one-megaton weapon would release energy equivalent to 1 million tons (or 1,000 kilotons) of TNT. Using powerful rockets, any such weapons could be delivered, in less than an hour, between any two points on earth. Nuclear explosions of more than fifty megatons have already occurred and even larger ones are possible, since there appears to be no upper limit to the yield of a nuclear weapon except in terms of practicable size and weight.

IN THE ATMOSPHERE

2. When a nuclear weapon is exploded in the atmosphere, 50 per cent of its total energy is released as blast and shock, 35 per cent as thermal radiation and 15 per cent as nuclear radiation (see figure IX). These proportions vary according to whether the explosion is carried out in the atmosphere, or at altitudes greater than 100,000 feet, or underground. At high altitudes, the proportion of

FIGURE IX. DISTRIBUTION OF ENERGY IN AN AIR-BURST OF A FISSION WEAPON AT AN ALTITUDE OF LESS THAN 100,000 FEET



energy converted into blast would be decreased while the proportion of intense thermal radiation would be increased; in the underground case, no thermal radiation would escape. A nuclear explosion thus differs characteristically from an explosion caused by conventional explosives, not only in that its explosive power is several orders of magnitude greater than for a conventional explosive of the same mass, but also in so far as it results in effects from thermal and nuclear radiation.

3. The blast effects and associated overpressures from any particular nuclear explosion depend on the power of the weapon exploded and the altitude at which the explosion occurs (tables 1 and 2). The thermal radiation travels through the atmosphere at the speed of light and to distances depending on visibility through the atmosphere at the time of the explosion (see figure X). It can be of sufficient intensity from a one-megaton explosion on a fairly clear day to cause moderately severe burns on exposed skin over a radius of twenty kilometres (table 3). The heat might be felt as far away as 120 km. Serious fires could be started in cities and forests, possibly leading to fire-storms, i.e., gigantic fires in which air is sucked into the centre of the burning region to create a flaming funnel which destroys everything within it. For atmospheric explosions, having an energy greater than one megaton, these distances would be even greater. It has been estimated that on a clear day, a ten-megaton bomb exploded at an altitude of fifty kilometres would scorch the earth's surface over an area with a radius of some seventy kilometres. The thermal energy received per unit area, at a specified distance from a nuclear explosion, is usually expressed in calories per square centimetre.

FIGURE X. TOTAL THERMAL ENERGY DELIVERED, AS A FUNCTION OF DISTANCE FROM A 20-KILOTON NUCLEAR BOMB, FOR DIFFERENT ATMOSPHERIC VISIBILITIES

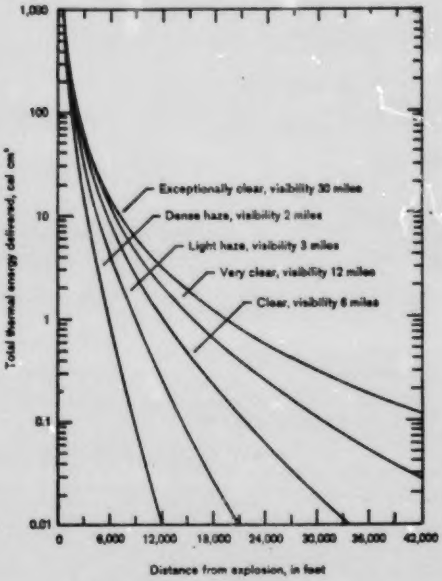
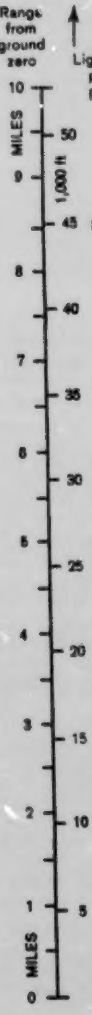


TABLE 1. DAMAGE RANGES FOR 20-KILOTON TYPICAL AIR-BURST AT HEIGHT OF ABOUT 600 METRES

Peak wind velocity (mph)	Positive phase duration (sec)	Peak dynamic pressure (psi)	Peak over-pressure (psi)	Range from ground zero: MILES	Range from ground zero: 1,000 ft	
				2		↑ Light damage to window frames and doors, moderate plaster damage out to about 4 miles; glass breakage possible out to 8 miles
70	0.95	0.09	2.0		10	
				1.8		Fine kindling fuels: ignited
79	0.94	0.12	2.3		9	Wood-frame buildings: moderate damage Smoke stacks: slight damage
				1.6		
98	0.92	0.17	2.7		8	
				1.4		
112	0.90	0.27	3.2		7	Wood-frame buildings: severe damage Radio and TV transmitting towers: moderate damage Wall-bearing, brick building (apartment house type): moderate damage
				1.2		
139	0.86	0.42	4.2		6	Wall-bearing, brick buildings (apartment house type): severe damage
				1.0		Telephone and power lines: limit of significant damage
190	0.80	0.80	6.0		5	Multi-story, wall-bearing buildings (monumental type): moderate damage Light steel-frame, industrial buildings: moderate damage
				0.8		
291	0.72	1.50	10.0		4	Multi-story, wall-bearing buildings (monumental type): severe damage
				0.6		Light steel-frame industrial buildings: severe damage Highway and RR truss bridges: moderate damage
431	0.63	3.90	16.3		3	Multi-story, steel-frame building (office type): severe damage
				0.4		Transportation vehicles: moderate damage Multi-story, blast-resistant designed, reinforced-concrete building: moderate damage
489	0.54	7.60	32.5		2	Multi-story, reinforced-concrete, frame building (office type): severe damage Multi-story, blast-resistant designed, reinforced-concrete buildings: severe damage
				0.2		All other (above ground) structures: severely damaged or destroyed
260	0.44	3.70	30.0		1	
				0	0	Ground zero for 20 kiloton air burst

TABLE 2. DAMAGE RANGES FOR 1-MEGATON TYPICAL AIR-BURST AT HEIGHT OF ABOUT 2,000 METRES

Peak wind velocity (mph)	Positive phase duration (sec)	Peak dynamic pressure (psi)	Peak over-pressure (psi)	Range from ground zero (1,000 ft)
44	3.45	0.036	1.2	50
51	3.45	0.049	1.4	45
60	3.44	0.072	1.7	40
72	3.43	0.11	2.1	35
98	3.40	0.18	2.6	30
117	3.24	0.26	3.5	25
177	3.02	0.60	5.5	20
278	2.86	1.40	9.4	15
464	2.25	6.22	10.0	10
307	1.75	3.60	27.0	5



Light damage to window frames and doors, moderate plaster damage out to about 15 miles; glass breakage possible out to 30 miles

Fine kindling fuels: ignited

Smokestacks: slight damage

Wood-frame buildings: moderate damage

Radio and TV transmitting towers: moderate damage

Wood-frame buildings: severe damage

Telephone and power lines: limit of significant damage

Wall-bearing, brick buildings (apartment house type): moderate damage

Wall-bearing, brick buildings (apartment house type): severe damage

Light steel-frame, industrial buildings: moderate damage

Light steel-frame, industrial buildings: severe damage

Multi-story, wall-bearing buildings (monumental type): moderate damage

Multi-story, wall-bearing buildings (monumental type): severe damage

Highway and RR truss bridges: moderate damage

Multi-story, steel-frame building (office type): severe damage

Transportation vehicles: moderate damage

Multi-story, reinforced-concrete frame buildings (office type): severe damage

Multi-story, blast-resistant designed, reinforced-concrete buildings: moderate

Multi-story, blast-resistant designed, reinforced-concrete buildings: severe

All other (above ground) structures: severely damaged or destroyed

Ground zero for 1 megaton air burst

TABLE 3. RANGES, IN KILOMETRES FROM GROUND-ZERO, AT WHICH FIRST- AND SECOND-DEGREE BURNS WOULD BE INFLICTED BY EXPLOSIONS OF VARIOUS MAGNITUDES IN THE ATMOSPHERE[*]

Degree of burn	*Distance in km from effective explosion*				
	1 kt	*10 kt*	*100 kt*	*1 Mt*	*10 Mt*
First-degree burn (reddening of skin)	1.12	3	8.5	22.4	48
Second-degree burn (blistering of skin)	0.8	2.4	6.4	18	38.4

[*] In the case of surface explosions, the corresponding distances would be approximately ⅘ those for an aerial explosion of the same effectiveness.

4. Figure XI shows the area over which blast and thermal radiation effects would occur for typical ten-kiloton, one-megaton and ten-megaton explosions in the atmosphere. Within the circle in which overpressure amounts to 0.35 kg/cm^2 most normal buildings would be completely destroyed. For blast overpressure of 0.07 kg/cm^2 window frames, doors and walls would be only slightly damaged. Within the central zone of heavy damage there would be great danger of fires and individuals would be exposed to effects of nuclear and thermal radiation as well as blast.

INITIAL NUCLEAR RADIATION

5. The nuclear radiation from a nuclear explosion, occurring in the atmosphere, may be further considered as consisting of one third initial radiation, i.e., produced within a minute or so of the explosion, and two thirds residual or delayed nuclear radiation, i.e., emitted over a much longer period of time. The initial radiation may cause radiation sickness or death in human beings, depending on the dose of radiation received (table 4). A radiation dose of 100 rads[a] does not usually have harmful consequences for an exposed organism. A dose of 200 rads may produce some blood changes while a dose of 1,000 rads will cause illness within four hours and death within two or three weeks. Doses of 400 to 500 rads will cause radiation sickness and a 50 per cent expectation of death. These dose estimates apply to acute gamma[b] radiation; the same effects would be produced by lower doses of neutrons (see also table 5).

6. The initial nuclear radiation from an explosion in the atmosphere also travels a long way in air, although the intensity falls off fairly rapidly with increasing distance from the explosion. Unlike thermal radiation, nuclear radiation passes easily through most physical barriers. Heavy layers of materials are needed to reduce the intensity of nuclear radiation to harmless proportions; e.g., at a distance of 1.5 kilometres from a one-megaton weapon, burst in the atmosphere, an individual would need the protection of about 30 cm of steel or 130 cm of concrete to be relatively safe from the effects of initial nuclear radiation. On the other hand, any opaque object such as buildings or protective clothing interposed between the nuclear explosion and exposed skin would provide protection against thermal radiation. This would remain true even if the building were subsequently destroyed by blast, since the main thermal radiation would have passed before the arrival of the blast wave.

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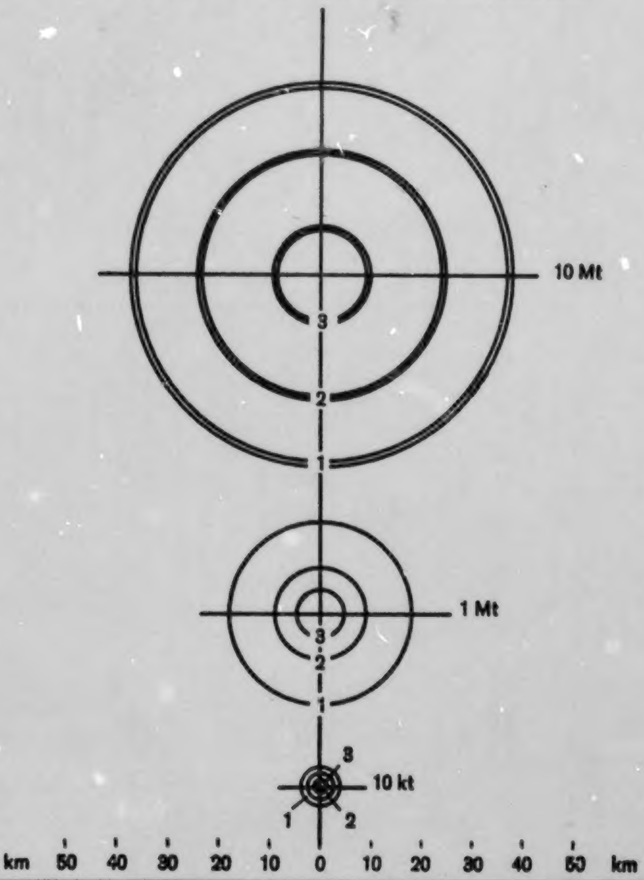
[a] Rad: A unit of absorbed dose of radiation; it represents the absorption of 100 ergs of nuclear (or ionizing) radiation per gramme of the absorbing material or tissue. An erg is a unit of work. It is the work done when a unit force of one dyne moves a body through one centimetre in the direction of action of the force.

[b] Gamma rays (or radiations) are electromagnetic radiations of high energy originating in atomic nuclei and accompanying many nuclear reactions, for example, fission and radio-activity.

TABLE 4. SUMMARY OF CLINICAL EFFECTS OF ACUTE IONIZING RADIATION DOSES

Range	0 to 100 rads — subclinical range	100 to 1,000 rads — therapeutic range (i.e., range in which therapy may be effective)			Over 1,000 rads — lethal range	
		100 to 200 rads	200 to 600 rads	600 to 1,000 rads	1,000 to 5,000 rads	Over 5,000 rads
		Clinical surveillance	Therapy effective	Therapy promising	Therapy palliative	
Incidence of vomiting	None	100 rads: 5 per cent 200 rads: 50 per cent	300 rads: 100 per cent	100 per cent	100 per cent	
Delay time	–	3 hours	2 hours	1 hour	30 minutes	
Leading organ	None	Haematopoietic tissue			Gastrointestinal tract	Central nervous system
Characteristic signs	None	Moderate leukopenia	Severe leukopenia; purpura; haemorrhage; infection; epilation above 300 rads		Diarrhoea; fever; disturbance of electrolyte balance	Convulsions; tremor; ataxia; lethargy
Critical period post-exposure	–	–	4 to 6 weeks		5 to 14 days	1 to 48 hours
Therapy	Reassurance	Reassurance; haematologic surveillance	Blood transfusion; antibiotics	Consider bone marrow transplantation	Maintenance of electrolyte balance	Sedatives
Prognosis	Excellent	Excellent	Good	Guarded	Hopeless	
Convalescent period	None	Several weeks	1 to 12 months	Long	–	
Incidence of death	None	None	0 to 80 per cent (variable)	80 to 100 per cent (variable)	90 to 100 per cent	
Death occurs within	–	–	2 months		2 weeks	2 days
Cause of death	–	–	Haemorrhage; infection		Circulatory collapse	Respiratory failure; brain oedema

FIGURE XI. ENVIRONMENTAL VARIATIONS DUE TO BLAST AND THERMAL RADIATION FOR 10 KT, 1-MT AND 10-MT EXPLOSIONS IN THE ATMOSPHERE


10 Mt
3
2
1
1 Mt
3
2
1
3
10 kt
1
2
km
50
40
30
20
10
0
10
20
30
40
50
km

No	Effects	10 kt		1 Mt		10 Mt	
		Range (km)	Area (km^2)	Range (km)	Area (km^2)	Range (km)	Area (km^2)
1	Second degree burns..,	2.4	18.1	18	1018	36.4	4362
2	Overpressure 0.07 kG/cm^2	1.6	8.0	8.8	243	19.2	1158
3	Overpressure 0.35 kG/cm^2	1.2	4.5	4.5	63.6	14.7	680

TABLE 5. RANGES, IN KILOMETRES FROM GROUND-ZERO, WITHIN WHICH AN ATMOSPHERIC EXPLOSION WILL PRODUCE GIVEN DOSES OF INITIAL NUCLEAR RADIATION[*]

	1 kt	*10 kt*	*100 kt*	*1 Mt*	*10 Mt*
Radiation dose					
100 rads	1.12	1.6	2.1	2.9	3.8
500 rads	0.96	1.3	1.8	2.4	3.4
1,000 rads	0.8	1.12	1.6	2.24	3.2

[*] Distances for corresponding radiation doses would be reduced in the case of surface explosions.

RESIDUAL NUCLEAR RADIATION (FALL-OUT)

7. Residual or delayed radiation[*] arises almost entirely from the radioactivity of the debris left by the explosion. The proportion of this radiation may vary according to the type of nuclear weapon exploded. Meteorological and gravitational forces cause the bomb debris to be spread widely through the atmosphere over the countryside. The heavier particles fall close to the scene of the explosion, descending like a mild sand-storm, while the lighter particles are carried downwind. Both the heavy and light particles contain fused fission products and are highly radio-active; they constitute "fall-out" containing some fission products which remain dangerously radio-active for a relatively short period of time and some which will remain dangerously radio-active for many years. The former category contributes most of the external radiation after the initial burst; it also contributes to internal radiation through iodine-131 which when absorbed in the body is concentrated in the thyroid. In the second (long-lived) category, strontium-90 and caesium-137 are the most important fission products leading to radioactive contamination of human diets.

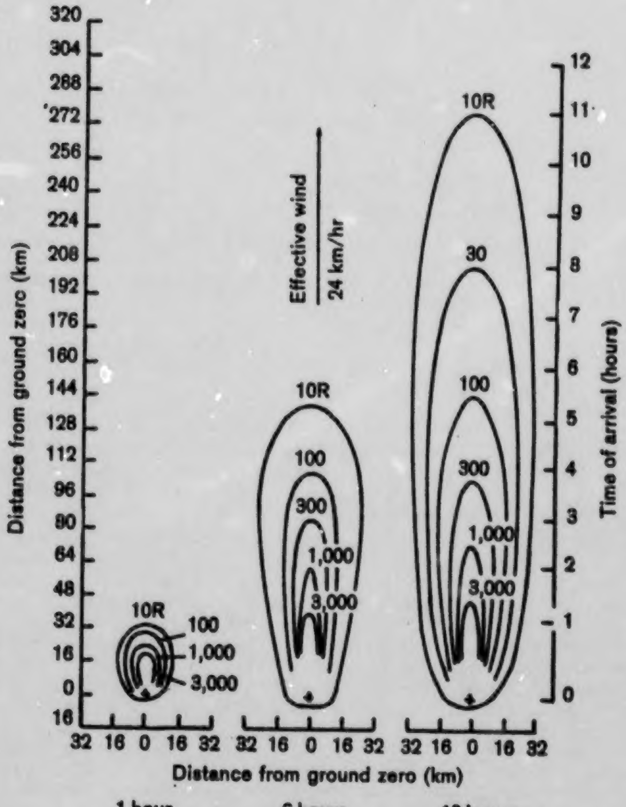
8. Relatively local fall-out may contaminate very extensive areas, depending on the size of the explosion, the height at which the explosion takes place, the wind pattern in the area at the time of the explosion and rain-out through the atmosphere (figure XII). Such an area may be of the order of some fifty square kilometres for a twenty-kiloton explosion, near the surface of the earth. In this case the debris would be largely confined to the lower atmosphere and about half of it would be removed, chiefly by rainfall, in a period of about three or four weeks, although some of the particles might circle the earth one or more times before being deposited. For an explosion of say ten megatons at the surface of the earth, intense local fall-out might extend as far as 500-600 km from the point of the explosion. If such an explosion occurred well above the surface of the earth, a considerable fraction of the debris would be carried into the stratosphere and, in these circumstances, some debris would require months or even years to return to earth. By that time a large proportion of the radio-active atoms produced by the explosion would have decayed.

9. In one particular incident, when a fifteen-megaton device was detonated in a nuclear test on a coral island, the resulting fall-out seriously contaminated an elongated area extending approximately 530 km downwind and varying in width up to nearly 100 km. In addition, there was a severely contaminated region upwind extending some thirty kilometres from the point of detonation. A total area of some 18,000 sq. km. was contaminated to such an extent that survival would

---

[*] Some delayed radiation may arise from radio-activity produced in materials in soil or structures as a result of nuclear reactions, following the capture of neutrons in such materials, after a nuclear explosion. This is known as induced XIII shows the estimated exposures that would have been received by individuals, radio-activity.

FIGURE XII. TOTAL-EXPOSURE CONTOURS FROM EARLY FALL-OUT AT 1, 6 AND 18 HOURS AFTER SURFACE-BURST WITH 1-MEGATON FISSION YIELD (24 KM/HR EFFECTIVE WIND SPEED). EXPOSURES IN ROENTGENS (R). ONE ROENTGEN OF GAMMA RADIATION CORRESPONDS TO THE ABSORPTION OF ABOUT 87 ERGS PER GRAMME OF AIR



have depended on evacuation of the area or taking protective measures. Figure remaining unprotected in the open, at various locations ninety-six hours following the explosion. Since an exposure of 700 rads spread over a period of ninety-six hours would probably prove fatal in a majority of cases, it follows that, for this particular explosion, there was sufficient radio-activity in a downwind belt of 270 km × 56 km to have threatened the lives of nearly all persons who remained in the area unprotected for at least ninety-six hours. At greater distances there would have been many cases of sickness resulting in temporary incapacity.

10. Residual radiation, liberated by the decay of nuclear debris, may cause an increase of several hundred times the radiation normally present as background radiation in any area and may seriously inhibit or even prevent local rescue and

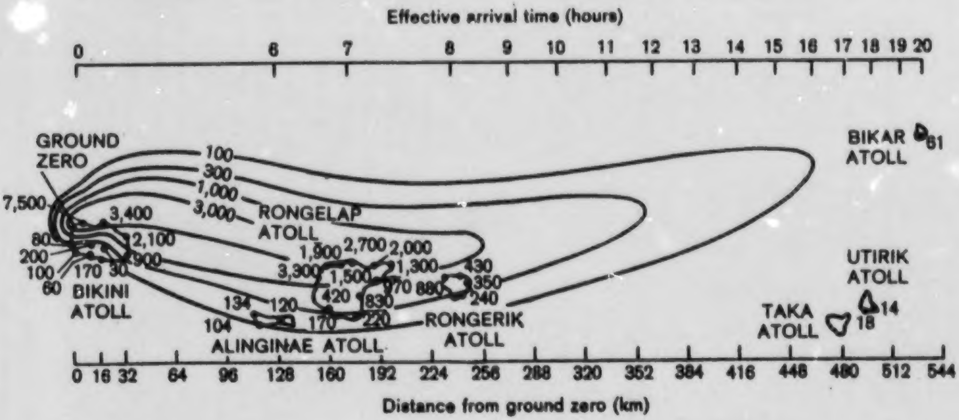

Effective arrival time (hours)
0
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
GROUND ZERO
100
300
1,000
3,000
7,500
3,400
RONGELAP ATOLL
BIKAR ATOLL
61
80
2,100
200
900
100
170
30
60
BIKINI ATOLL
1,900
2,700
2,000
3,300
1,500
1,300
430
350
970
880
420
830
240
UTIRIK ATOLL
14
134
120
104
170
220
RONGERIK ATOLL
TAKA ATOLL
18
ALINGINAE ATOLL
0
16
32
64
96
128
160
192
224
256
288
320
352
384
416
448
480
512
544
Distance from ground zero (km)

Figure XIII. Estimated total-exposure contours in roentgens at 96 hours after the BRAVO test explosion

relief operations. Apart from the direct hazard of such additional radiation to human beings, there is an indirect hazard from heavy fall-out contamination of soil, plant life and water supplies, through subsequent ingestion of contaminated food supplies. In the incident reported in the previous paragraph, the people exposed at Rongelap, particularly children, also received high doses of radiation to the thyroid due to internal radiation from ingested radio-iodine. Water supplies may well be rendered temporarily unusable. These direct and indirect hazards add to the immediate physical disaster of a nuclear explosion by producing radiation sickness and death for sections of the population who, being on the periphery of the immediate damage area, would otherwise have appeared to survive the explosion. In fact the human casualties may be caused at distances where the immediate physical effects of the explosion are totally absent.

11. It can be calculated that a hypothetical nuclear attack of 10,000 megatons in ground-bursts could, in the course of sixty days, destroy 80 per cent of the population of the United States, if unprotected, while an attack of 20,000 megatons could cover the entire country with radio-active fall-out, killing 95 per cent of the unprotected population. Similarly in the Soviet Union, which has an area greater than that of the United States, a 10,000 megaton blow could wipe out 75 per cent of the population, whereas a 20,000 megaton attack could increase the population losses to around 90 per cent.

12. Fall-out from nuclear explosions still provides a major contribution to the radio-active contamination of our natural environment. The rate at which it is deposited over the world depends on a number of factors, including the total amount of radio-active material remaining in the stratosphere. Any injection of nuclear debris into the stratosphere, as a result of high-yield nuclear explosions, is followed after a period of time by a rise in fall-out rates roughly proportional to the amount injected. In the absence of further atmospheric nuclear tests, depletion of the stratosphere progressively takes place and the rate of fall-out decreases accordingly. The global rates of deposition have been well documented in a series of publications by the United Nations Scientific Committee on the Effects of Atomic Radiation. These relate to studies from the beginning of nuclear tests and continue through the years of public concern about long-term radiation hazards, beginning with the intensive nuclear weapon testing in the atmosphere in the 1950s, and including the intensive atmospheric testing in 1961/1962, immediately before the nuclear test ban treaty of 1963. Although that treaty sought to prohibit any further nuclear weapon testing in the atmosphere, some further testing in the atmosphere has been carried out by two countries which did not sign the test ban treaty. However, the United Nations Scientific Committee reported in 1966 that the atmospheric tests in central Asia up to that year contributed negligibly to the risk of radiation, as compared with that already existing from the previous injection of nuclear debris into the stratosphere.

UNDERWATER EXPLOSIONS

13. In explosion under water, as in the case of a nuclear explosion in the atmosphere, a fire-ball is again formed and the rapid expansion of hot gases initiates a shock wave. But the fire-ball is much smaller, and remains visible only until the bubble of constituent hot high-pressure gases and steam reaches the surface of the water. The shock wave causes a spray dome to rise over the point of burst, with time of rise and height of dome depending on the energy yield of the explosion and the depth of detonation. Details of underwater nuclear explosions carried out in the Pacific in 1946 and 1958 are given in annex III, reference 1.

14. Thermal radiation emitted from the fire-ball while under water would be absorbed by the surrounding water. So, too, is the initial nuclear radiation although, as soon as the fire-ball reaches the surface, gamma radiation from fission

products in the water column and the subsequent radio-active cloud acts as initial nuclear radiation. The water fall-out from the cloud, and the "base surge" (spray rising from water surface), would be responsible for delayed or residual nuclear radiation. Thus, since in this case the "initial" nuclear radiation merges continuously with that produced over a period of time, it is less meaningful to make the same kind of distinction between initial and residual radiation as applies in the case of an explosion in the atmosphere.

15. After an underwater nuclear explosion, most of the radio-activity remaining in the water and on the bottom would be found initially in the vicinity of the explosion. Table 6 shows the rate of spread of radio-active material and the decrease in dose rate, following the shallow underwater explosion in the Pacific in 1946. For detonations in deep water some activity may be left on the surface to diffuse rapidly downward and outward, thus reducing the radio-activity level to safe limits for personnel.

16. Radio-activity falling back from the high airborne cloud on to the sea extends downward much farther than "base surge" contamination or that transported by the water. The fall-out debris quickly mixes with the water and, since the water absorbs (or attenuates) the radiation to a considerable extent, the radio-active hazard is much less than would result from the same fall-out over land. The radio-active material is gradually transported to other locations by prevailing currents and, if these are known, the path of the contaminated water can be predicted.

TABLE 6. DIMENSIONS AND DOSE RATE IN CONTAMINATED WATER AFTER THE 20 KT UNDERWATER EXPLOSION AT BIKINI, 1946

Time after explosion (hours)	*Mean diameter of contaminated area (km)*	*Maximum dose rate (rads per hr)*
4	7.3	3.1
38	7.6	0.42
62	12.0	0.21
86	13.6	0.042
100	15.2	0.025
130	18.4	0.008
200	20.8	0.0004

Source: United Nations. Effects of the Possible Use of Nuclear Weapons and the Security and Economic Implications for States of the Acquisition and Further Development of These Weapons. Report of the Secretary General. 1968.

Glasstone (AEC)

EQUIVALENTS OF 1 KILOTON OF TNT

Complete fission of 0.056 kg (56 grams) fissionable material
Fission of 1.45×10^{23} nuclei
10^{12} calories
4.2×10^{19} ergs
1.15×10^{6} kilowatt-hours
1.8×10^{9} British thermal units

Source: Glasstone, op. cit., p. 14

Hildenbrand: Fast Critical Masses of Fissile Material for Nuclear Explosives, 1977 (kg)

	Percent Fissile Isotope						
	20	50	60	70	80	90	100
U Metal (U-235)							
Without Reflector (kg U)		145	105	82	68	54	50
With Be Reflector (kg U)	250	50					15
Pu Metal (Pu-239)							
Without Reflector (kg Pu)				23			15
With Be Reflector (kg Pu)				8			4
U Metal (U-233)							
Without Reflector (kg U)							17
With Be Reflector (kg U)							4-5

Note: Critical masses of oxides are 1.5 x critical masses of metals. Weapon uranium = 90% or more enrichment; reactor uranium = 3%, spent fuel 0.8%. Weapon plutonium = Pu-239 of 98% or more purity.

Source: Gunter Hildenbrand. Nuclear energy, nuclear exports and the non-proliferation of nuclear weapons. AIF Conference on International Commerce and Safeguards for Civil Nuclear Power. March 1977.

SIPRI: LIST OF FIRST NUCLEAR EXPLOSIONS

Fission devices				Thermonuclear devices		
Country	Year of first explosion	Fissile material	Source of fissile material	Year of first explosion	Fissile material	Source of fissile material
USA	1945	Pu-239	Reactor	1952	U-235	Gaseous diffusion
USSR	1949	Pu-239	Reactor	1952	U-235	Gaseous diffusion
UK	1952	Pu-239	Reactor	1957	U-235	Gaseous diffusion
France	1960	Pu-239	Reactor	1968	U-235?	Gaseous diffusion
China	1964	U-235	Gaseous diffusion	1967	U-235	Gaseous diffusion
India	1974	Pu-239	Reactor	–	–	–

Source: Stockholm International Peace Research Institute, Nuclear energy and nuclear weapons proliferation. London: Taylor and Francis Ltd., 1979, p. 2.

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SIPRI: NUCLEAR EXPLOSIONS, 1945–83 (KNOWN AND PRESUMED)

I. 16 July 1945–5 August 1963 (the signing of the Partial Test Ban Treaty)

USA[a]	USSR	UK	France	Total
331	164	23	8	526

II. 6 August 1963–31 December 1983

a atmospheric
u underground

	USA[a]		USSR		UK		France		China		India		
Year	a	u	a	u	a	u	a	u	a	u	a	u	Total
6 Aug–31 Dec 1963	0	14	0	0	0	0	0	1					15
1964	0	29	0	6	0	1	0	3	1	0			40
1965	0	28	0	9	0	1	0	4	1	0			43
1966	0	40	0	15	0	0	5	1	3	0			64
1967	0	28	0	15	0	0	3	0	2	0			48
1968	0	33[b]	0	13	0	0	5	0	1	0			52
1969	0	29	0	15	0	0	0	0	1	1			46
1970	0	30	0	12	0	0	8	0	1	0			51
1971	0	12	0	19	0	0	5	0	1	0			37
1972	0	8	0	22	0	0	3	0	2	0			35
1973	0	9	0	14	0	0	5	0	1	0			29
1974	0	7	0	19	0	1	7	0	1	0	0	1	36
1975	0	16	0	15	0	0	0	2	0	1	0	0	34
1976	0	15	0	17	0	1	0	4	3	1	0	0	41
1977	0	12	0	16	0	0	0	6	1	0	0	0	35
1978	0	12	0	27	0	2	0	7	2	1	0	0	51
1979	0	14	0	29	0	1	0	9	0	0	0	0	53
1980	0	14	0	21	0	3	0	11	1	0	0	0	50
1981	0	16	0	21	0	1	0	11	0	0	0	0	49
1982	0	18[c]	0	31	0	1	0	5	0	0	0	0	55
1983	0	14	0	27	0	1	0	7	0	1	0	0	50[d]
Total	0	398	0	363	0	13	41	71	22	5	0	1	914

[a] Data for the USA take into account information in *Announced United States Nuclear Tests* (January 1983), prepared by the US Department of Energy in co-operation with Los Alamos, Lawrence Livermore and Sandia National Laboratories.
[b] Five devices used simultaneously in the same test are counted here as one explosion.
[c] Two devices used simultaneously in the same test are counted here as one explosion.
[d] The data for 1983 are preliminary.

III. 16 July 1945–31 December 1983

USA	USSR	UK	France	China	India	Total
729	527	36	120	27	1	1 440

Source: Stockholm International Peace Research Institute. World armaments and disarmament. SIPRI yearbook, 1984. London: Taylor & Francis. 1984. p. 60

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ROUTES TO NUCLEAR WEAPONS

CONTENTS

Page

Introduction 301

ACDA: Number of potential nuclear weapons per year from a 1,000 MWe civilian power reactor, 1976 302

OTA:

- Diversion Points From the LWR Fuel Cycle, 1977 303
- Summary of diversion points in the LWR fuel cycle, 1977 304
- Reactor diversion report card, 1977 305
- Reactor systems resistance to proliferation, 1977 306
- Diversion controls, 1977 307

SIPRI: Plutonium production in various types of reactors, 1979 308

Westinghouse:

- Personnel requirements for various proliferation routes, 1977 309
- Reliabilities of weapons produced by various proliferation routes, 1977 310

Estimated material conversion times to finished plutonium or uranium metal components (IAEA, 1980) 311

ROUTES TO NUCLEAR WEAPONS

INTRODUCTION

There are several ways a nation can get the materials to make a nuclear explosive. One is to divert weapons-usable materials from a civilian nuclear fuel cycle. This would be feasible if highly enriched uranium or plutonium are used in the civilian nuclear fuel cycle. Most fuel cycles do not use these materials, however. Another route is to build and operate facilities dedicated exclusively to the production of weapons-usable materials. A third would be to divert fissionable material from a civil fuel cycle, and then further process the material to produce highly enriched uranium or plutonium. The first route is often postulated for nonnuclear weapon states. The second is recognized but given little credence at present. The third is a possibility for states that have the industrial facilities to upgrade conventional nuclear fuels.

A nation contemplating the production of nuclear weapons must balance many factors, including access to necessary technologies and materials; the political and military advantages and disadvantages of possessing nuclear weapons; the cost and technical difficulty; and the risk of detection.

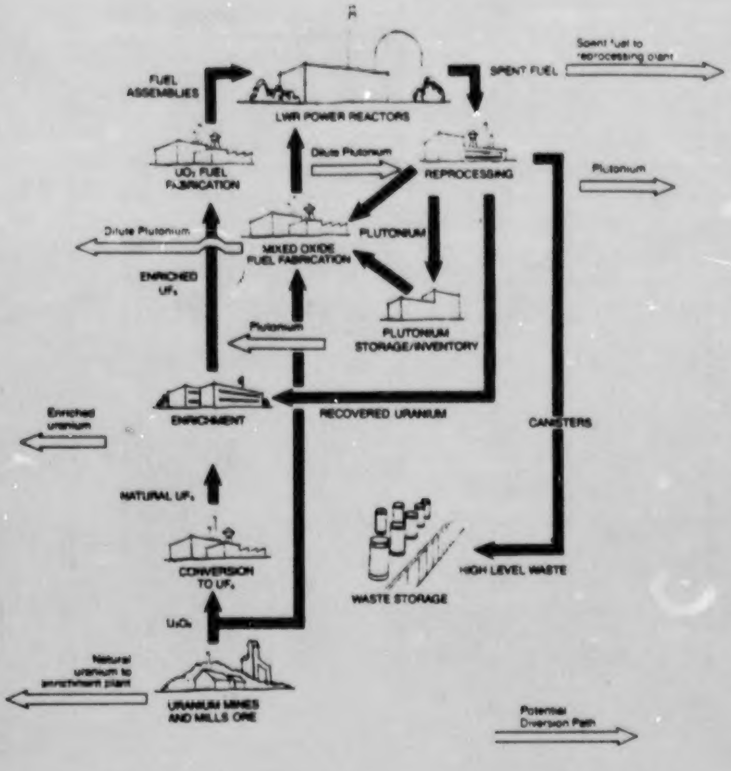
ACDA: NUMBER OF POTENTIAL NUCLEAR WEAPONS PER YEAR FROM A 1,000-Mw CIVILIAN POWER REACTOR, 1976

Reactor type	Potential weapons[1] per year	Remarks
LWR—Light water reactor	10–70	This is the type of reactor produced currently in the United States. Weapons from plutonium output if spent fuel is reprocessed. If plutonium recycle used, up to 50 weapons available from annual input.
Natural uranium heavy water reactor	10–50	Weapons from plutonium output if plutonium is reprocessed. But plutonium recycle appears less economically attractive.
HTGR—High temperature gas cooled reactor	10–40	Weapons from U-233 output. Initial loading involves enough highly enriched uranium for up to 70 weapons. In all cases uranium must undergo physical and/or chemical treatment.
LMFBR—Liquid metal fast breeder reactor	20–100	Weapons from plutonium output after reprocessing. Depending on design, initial loading involves enough plutonium for up to 500 weapons. LMFBR plutonium is generally of high fissile content, but must be separated from fuel.

[1] Based on a range of assumptions about the quantity of nuclear material in weapons and the design and operating characteristics of nuclear reactors.

Source: U.S. Arms Control and Disarmament Agency. Arms Control Report, July 1976, Publication No. 89, p. 17.

OTA: Diversion Points From the LWR Fuel Cycle, 1977

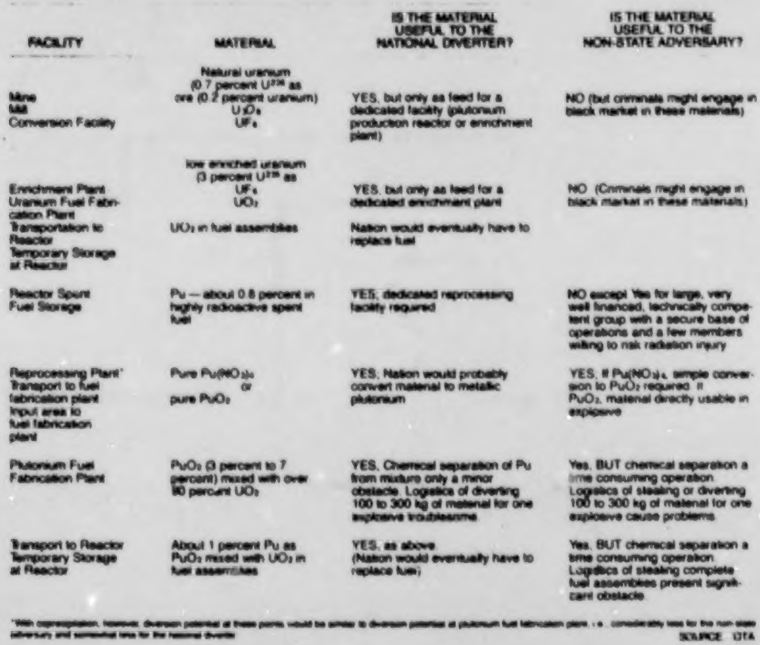

FUEL ASSEMBLIES
LWR POWER REACTORS
SPENT FUEL
Spent fuel to reprocessing plant
UO_2 FUEL FABRICATION
Dilute Plutonium
REPROCESSING
Plutonium
Dilute Plutonium
MIXED OXIDE FUEL FABRICATION
PLUTONIUM
ENRICHED UF_6
Plutonium
PLUTONIUM STORAGE/INVENTORY
ENRICHMENT
RECOVERED URANIUM
Enriched uranium
CANISTERS
NATURAL UF_6
CONVERSION TO UF_6
WASTE STORAGE
HIGH LEVEL WASTE
U_3O_8
Natural uranium to enrichment plant
URANIUM MINES AND MILLS ORE
Potential Diversion Path

Source: U.S. Office of Technology Assessment.
Nuclear Proliferation and Safeguards, 1977, p. 24.

OTA: Summary of the Diversion Points in the LWR Fuel Cycle, 1977

Figure VII-2

Summary of the Diversion Points in the LWR Fuel Cycle



FACILITY	MATERIAL	IS THE MATERIAL USEFUL TO THE NATIONAL DIVERTER?	IS THE MATERIAL USEFUL TO THE NON-STATE ADVERSARY?
Mine Mill Conversion Facility	Natural uranium (0.7 percent U^{235} as ore (0.2 percent uranium) U_3O_8 UF_6	YES, but only as feed for a dedicated facility (plutonium production reactor or enrichment plant)	NO (but criminals might engage in black market in these materials)
Enrichment Plant Uranium Fuel Fabrication Plant	low enriched uranium (3 percent U^{235} as UF_6 UO_2	YES, but only as feed for a dedicated enrichment plant	NO (Criminals might engage in black market in these materials)
Transportation to Reactor Temporary Storage at Reactor	UO_2 in fuel assemblies	Nation would eventually have to replace fuel	
Reactor Spent Fuel Storage	Pu — about 0.8 percent in highly radioactive spent fuel	YES; dedicated reprocessing facility required	NO except Yes for large, very well financed, technically competent group with a secure base of operations and a few members willing to risk radiation injury
Reprocessing Plant* Transport to fuel fabrication plant Input area to fuel fabrication plant	Pure $Pu(NO_3)_4$ or pure PuO_2	YES; Nation would probably convert material to metallic plutonium	YES, if $Pu(NO_3)_4$, simple conversion to PuO_2 required. If PuO_2, material directly usable in explosive
Plutonium Fuel Fabrication Plant	PuO_2 (3 percent to 7 percent) mixed with over 90 percent UO_2	YES. Chemical separation of Pu from mixture only a minor obstacle. Logistics of diverting 100 to 300 kg of material for one explosive troublesome.	Yes, BUT chemical separation a time consuming operation. Logistics of stealing or diverting 100 to 300 kg of material for one explosive cause problems.
Transport to Reactor Temporary Storage at Reactor	About 1 percent Pu as PuO_2 mixed with UO_2 in fuel assemblies	YES, as above. (Nation would eventually have to replace fuel)	Yes, BUT chemical separation a time consuming operation. Logistics of stealing complete fuel assemblies present significant obstacle.

*With coprecipitation, however, diversion potential at these points would be similar to diversion potential at plutonium fuel fabrication plant, i.e., considerably less for the non-state adversary and somewhat less for the national diverter.

SOURCE: OTA

Source: Ibid, p. 157

OTA: Reactor Diversion Report Card, 1977

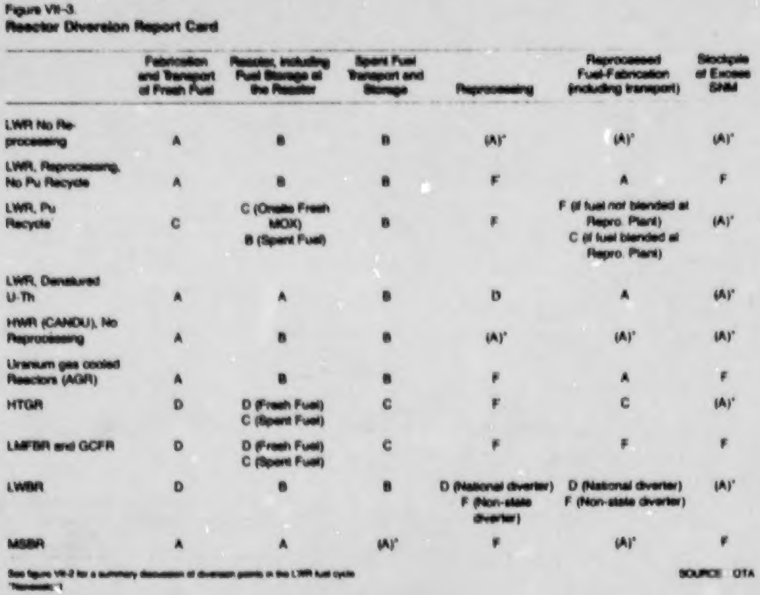


Figure VII-3.
Reactor Diversion Report Card

	Fabrication and Transport of Fresh Fuel	Reactor, including Fuel Storage at the Reactor	Spent Fuel Transport and Storage	Reprocessing	Reprocessed Fuel-Fabrication (including transport)	Stockpile of Excess SNM
LWR No Reprocessing	A	B	B	(A)[a]	(A)[a]	(A)[a]
LWR, Reprocessing, No Pu Recycle	A	B	B	F	A	F
LWR, Pu Recycle	C	C (Onsite Fresh MOX) B (Spent Fuel)	B	F	F (if fuel not blended at Repro. Plant) C (if fuel blended at Repro. Plant)	(A)[a]
LWR, Denatured U-Th	A	A	B	D	A	(A)[a]
HWR (CANDU), No Reprocessing	A	B	B	(A)[a]	(A)[a]	(A)[a]
Uranium gas cooled Reactors (AGR)	A	B	B	F	A	F
HTGR	D	D (Fresh Fuel) C (Spent Fuel)	C	F	C	(A)[a]
LMFBR and GCFR	D	D (Fresh Fuel) C (Spent Fuel)	C	F	F	F
LWBR	D	B	B	D (National diverter) F (Non-state diverter)	D (National diverter) F (Non-state diverter)	(A)[a]
MSBR	A	A	(A)[a]	F	(A)[a]	F

See figure VII-2 for a summary discussion of diversion points in the LWR fuel cycle.
[a] Nonexistent

SOURCE: OTA

Source: Ibid, p. 165

OTA: Reactor Systems Resistance to Proliferation, 1977

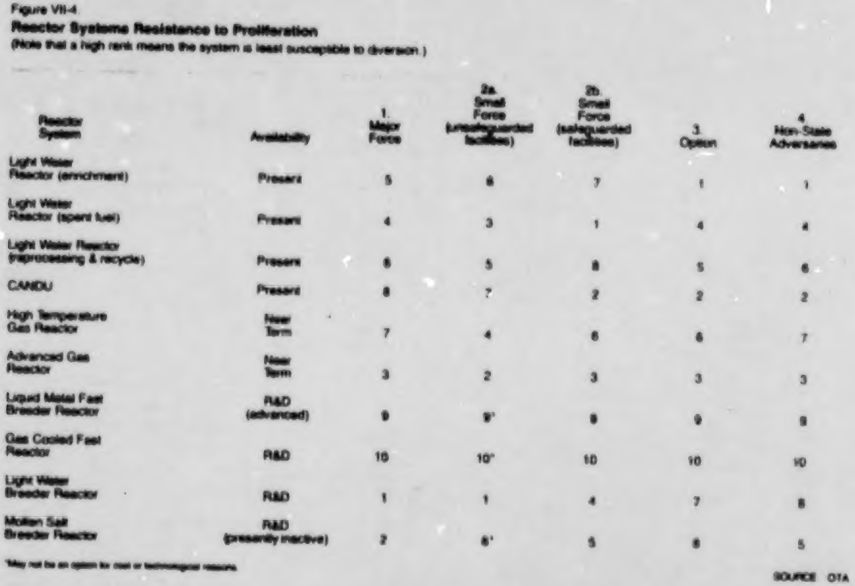


Figure VII-4

Reactor Systems Resistance to Proliferation

(Note that a high rank means the system is least susceptible to diversion.)

Reactor System	Availability	1. Major Force	2a. Small Force (unsafeguarded facilities)	2b. Small Force (safeguarded facilities)	3. Option	4. Non-State Adversaries
Light Water Reactor (enrichment)	Present	5	6	7	1	1
Light Water Reactor (spent fuel)	Present	4	3	1	4	4
Light Water Reactor (reprocessing & recycle)	Present	6	5	8	5	6
CANDU	Present	8	7	2	2	2
High Temperature Gas Reactor	Near Term	7	4	6	6	7
Advanced Gas Reactor	Near Term	3	2	3	3	3
Liquid Metal Fast Breeder Reactor	R&D (advanced)	9	9*	9	9	9
Gas Cooled Fast Reactor	R&D	10	10*	10	10	10
Light Water Breeder Reactor	R&D	1	1	4	7	8
Molten Salt Breeder Reactor	R&D (presently inactive)	2	8*	5	8	5

*May not be an option for cost or technological reasons.

SOURCE OTA

Source: Ibid, p. 167

OTA: Diversion Controls, 1977

Figure IX-1 Controls

Route	Detection	Deterrence	Limit Opportunities	Political Climate Conducive to Nonproliferation
Covert Diversion	Safeguards	Sanctions Political pressure Curses, spells & incantations	Export control of facilities Spent fuel return Technological measures (e.g., nonproliferation reactors) Multinational Fuel Cycle Facilities Guaranteed fuel supply International management of the fuel cycle	Weaken incentives Strengthen security of Nth countries (e.g., Security guarantees, military assistance, etc.) Reduce prestige of nuclear weapons (e.g., arms control) Resolve international disputes Strengthen political disincentives Increase the political costs Strengthen domestic anti-proliferation forces
Overt Diversion	Not needed	Sanctions Political pressure Curses, spells & incantations	(except G.F.S.)	Strengthen NPT Improve benefits to parties Enhance role of non-nuclear countries in international nuclear decisionmaking Link aid and nuclear exports to NPT Expand IAEA functions
Dedicated Facilities	Intelligence	Sanctions Political pressure Curses, spells & incantations	Secrecy for new developments Exports controls	Nuclear Free Zones Global and regional arrangements (e.g., MNFCFs)
Purchase/Theft	Safeguards & Intelligence	International coordination of police	Physical security weapons protection (e.g., PAL) Technological measures (e.g., coprecipitation)	Moderate grievances

SOURCE: OTA

Source: Ibid, p. 232.

SIPRI: PLUTONIUM PRODUCTION IN VARIOUS TYPES OF REACTOR

Type of reactor	Irradiation level of heavy metal (MWd/kg)	Average enrichment (% U-235)	Initial fuel inventory (kg/MW(e))		Pu-239 production (g/MW(e) yr)
			Core (natural U)	Blanket (depleted U)	
BWR	17	2	434	–	250
PWR	22.6	2.3	365	–	255
AGR	–	1.6	620	–	100
HWR (CANDU)	6	0.711	143	–	490
HTGR (USA)	54.5	~93	326	–	–
SGHWR	15.5	1.8	520	–	150
FBR (UK)	~70	–	9.5 (depleted U) 2.8 (Pu)[a]	16.9 (depleted U)	2850 (core Pu)[b] 409 (blanket Pu)[b]

[a] Plutonium composition is 57 per cent Pu-239, 24 per cent Pu-240, 14 per cent Pu-241 and 5 per cent Pu-242.

[b] Total of 2 980 kg/yr containing 58 per cent Pu-239, 28 per cent Pu-240, 9 per cent Pu-241 and 5 per cent Pu-242.

Source: Stockholm International Peace Research Institute, Nuclear energy and nuclear weapons proliferation. London: Taylor and Francis Ltd., 1979, p. 2.

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Westinghouse: Personnel Requirements for Various Proliferation Routes, 1977

Route	Construction		Operations	
	Technicians	Mgrs./Professionals	Technicians	Mgrs./Professionals
Chemical/Biological	–	–	< 10	–
Fission product dispersal	–	–	< 10	–
Centrifuge isotope separation	200-500	10-20	≈ 50	≈ 10
Research reactor	≈ 50	≈ .5	≈ 5	1
Mass spectrograph	200-500	10-20	≈ 100	≈ 10
Graphite pile	100-200	10-20	≈ 10	≈ 5
Heavy water reactor	100-200	10-20	≈ 30	≈ 10
Gaseous diffusion	200-500	10-20	≈ 50	≈ 10
Laser	?	?	?	?
CANDU	2000-10,000	100-200	≈ 100	≈ 10
HTGR	2000-10,000	100-200	≈ 100	≈ 10
LWR	2000-10,000	100-200	≈ 100	≈ 10
LMFBR	2000-10,000	100-200	≈ 100	≈ 10

Source: Westinghouse Electric Corp.

Westinghouse: Reliabilities of Weapons Produced by Various Proliferation Routes, 1977

Route	Explosive	Reliability
Chemical/biological	Chemical	Very high
Fission product dispersal	Chemical	Very high
Centrifuge	90+% enriched U	Very high
Research reactor	Pu: few percent Pu-240	High
Mass spectrograph	90+% enriched U	Very high
Graphite pile	Pu: few percent Pu-240	High
HWR	Pu: few percent Pu-240	High
Diffusion isotope separation	90+% enriched U	Very high
Laser	90+% enriched U	Very high
CANDU	Pu 58/32/7/3% 239/240/241/242	Low
HTGR	90+% enriched U	Very high
LWR	Pu 2/63/19/12/4% 238/239/240/241/242	Low
LMFBR	Coprocessed plutonium ~ 20% Pu-240	Low

Source: Westinghouse Electric Corp.

ESTIMATED MATERIAL CONVERSION TIMES TO FINISHED PLUTONIUM OR URANIUM METAL COMPONENTS

Beginning material form	Conversion time
Metals	
Pu, HEU or U-233 Metal	Order of days (7-10)
Compounds	
PuO_2, $Pu(NO_3)_4$, or other pure Pu compounds; HEU or U-233 oxide or other pure compounds; MOX or other non-irradiated pure mixtures containing Pu, U[(U-233 + U-235)>20%]; Pu, HEU and/or U-233 in scrap or other miscellaneous impure compounds	Order of weeks (1-3)*
Spent fuel	
Pu, HEU or U-233 in irradiated fuel**	Order of months (1-3)
Enriched uranium	
U containing <20% U-235 and U-233; Th	Order of one year

* This range is not determined by any single factor but the pure Pu and U compounds will tend to be at the lower end of the range and the mixtures and scrap at the higher end.

** Criteria for establishing the irradiation to which this classification refers are under review.

Source: IAEA Safeguards Glossary, IAEA/SG/INF/1, 1980, p. 21.

THE NUCLEAR FUEL CYCLE

CONTENTS

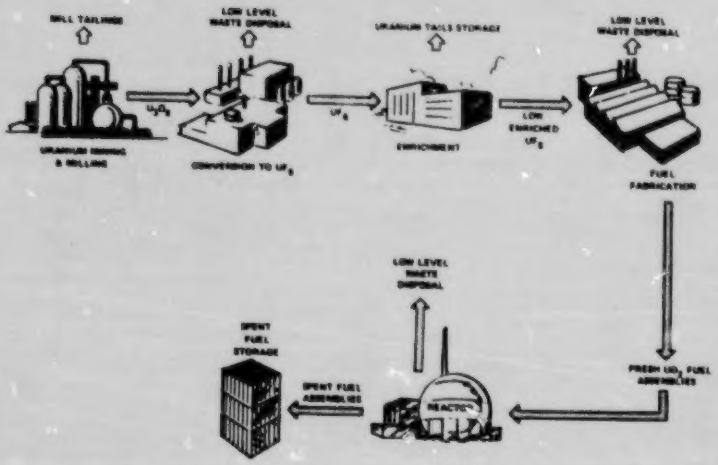
Page
Introduction 315
NASAP: The once through fuel cycle (1980) 316
NASAP: The closed fuel cycle (1980) 317
DOE: Reference fast breeder system (1980) 318
INFCE: Primer on the nuclear fuel cycle (1980) 319
Nuclear fuel cycle requirements in OECD to 2000 (OECD/NEA, 1985) 323

THE NUCLEAR FUEL CYCLE

INTRODUCTION

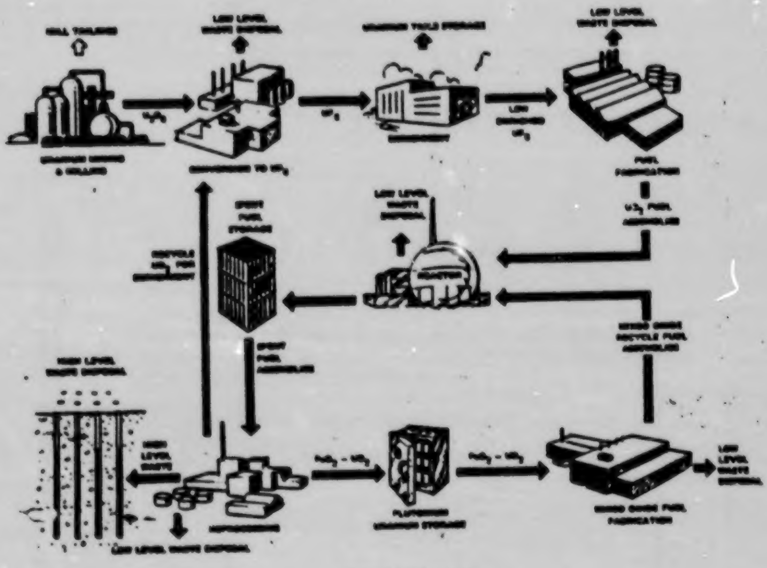
The nuclear fuel cycle consists of all the industrial operations necessary to fuel nuclear power plants. It includes the mining and milling of uranium ores, enrichment of uranium, fabrication and use of nuclear fuel, reprocessing of used nuclear fuel, and disposal or long-term management of radioactive wastes or unprocessed spent fuel. Some nuclear materials present little risk of immediate use to make nuclear weapons if stolen or diverted; others may be more readily used to make nuclear explosives. Those materials of greatest concern are highly enriched uranium, uranium-233, and high quality plutonium. Natural uranium and slightly enriched uranium present comparatively little risk because neither can be used directly to make nuclear explosives. The nuclear facilities most sensitive from a proliferation point of view include enrichment and reprocessing plants, stores of weapons quality materials, and fuel fabrication plants using such materials, as well as sensitive materials in transit.

NASAP: The Once Through Fuel Cycle


MILL TAILINGS
LOW LEVEL WASTE DISPOSAL
URANIUM TAILS STORAGE
LOW LEVEL WASTE DISPOSAL
U_3O_8
UF_6
LOW ENRICHED UF_6
URANIUM MINING & MILLING
CONVERSION TO UF_6
ENRICHMENT
FUEL FABRICATION
LOW LEVEL WASTE DISPOSAL
SPENT FUEL STORAGE
SPENT FUEL ASSEMBLIES
REACTOR
FRESH UO_2 FUEL ASSEMBLIES

Source: Department of Energy. Nuclear Proliferation and Civilian Nuclear Power. Final Report of the Nonproliferation Alternative Systems Assessment Program. Vol. IX: Reactor and Fuel Cycle Descriptions. June 1980, p. 279.

NASAP: The Closed Fuel Cycle

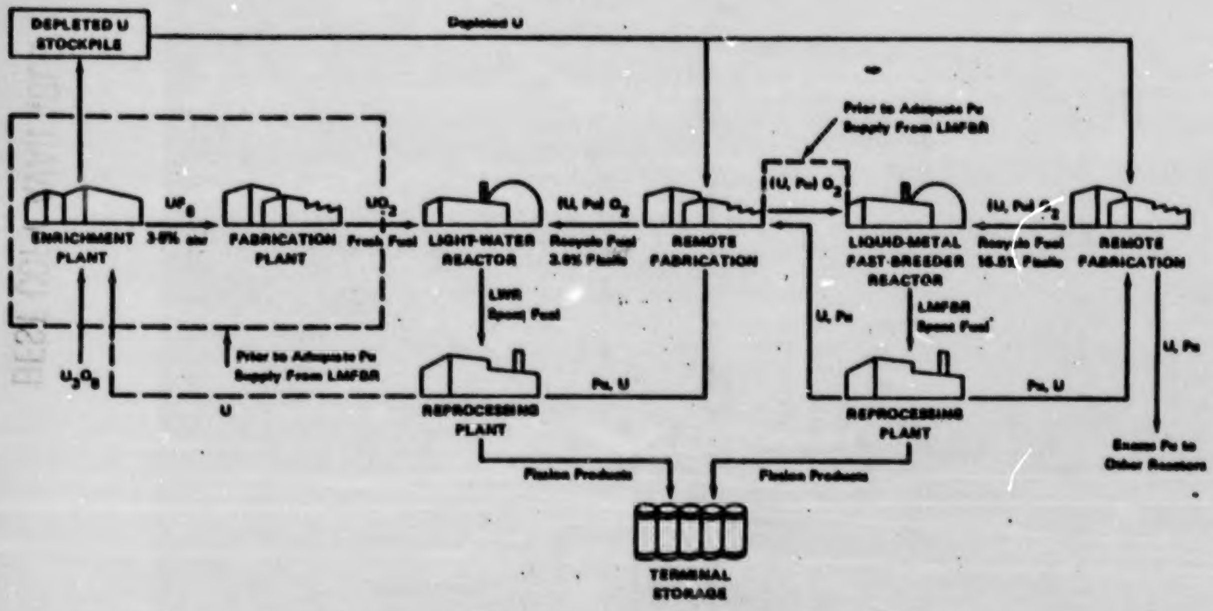

MILL TAILINGS
LOW LEVEL WASTE DISPOSAL
URANIUM TAILS STORAGE
LOW LEVEL WASTE DISPOSAL
URANIUM MINING & MILLING
CONVERSION TO UF6
ENRICHMENT
LOW ENRICHED UF6
FUEL FABRICATION
UO2 FUEL ASSEMBLIES
LOW LEVEL WASTE DISPOSAL
REACTOR
SPENT FUEL STORAGE
RECYCLE UO2 FOR ENRICHMENT
SPENT FUEL ASSEMBLIES
MIXED OXIDE RECYCLE FUEL ASSEMBLIES
HIGH LEVEL WASTE DISPOSAL
HIGH LEVEL WASTE
REPROCESSING
LOW LEVEL WASTE DISPOSAL
PuO2 – UO2
PLUTONIUM URANIUM STORAGE
PuO2 – UO2
MIXED OXIDE FUEL FABRICATION
LOW LEVEL WASTE DISPOSAL

Illustrative Closed Fuel Cycle

Source: Ibid., p. [illegible].

BEST COPY AVAILABLE

DOE: Reference Fast Breeder System


DEPLETED U STOCKPILE
Depleted U
Prior to Adequate Pu Supply From LMFBR
UF_6
3-5% enr
UO_2
Fresh Fuel
$(U, Pu) O_2$
Recycle Fuel 3.0% Fissile
$(U, Pu) O_2$
$(U, Pu) O_2$
Recycle Fuel 16.5% Fissile
ENRICHMENT PLANT
FABRICATION PLANT
LIGHT-WATER REACTOR
REMOTE FABRICATION
LIQUID-METAL FAST-BREEDER REACTOR
REMOTE FABRICATION
LWR Spent Fuel
U, Pu
LMFBR Spent Fuel
U, Pu
U_3O_8
Prior to Adequate Pu Supply From LMFBR
Pu, U
Pu, U
U
REPROCESSING PLANT
REPROCESSING PLANT
Excess Pu to Other Reactors
Fission Products
Fission Products
TERMINAL STORAGE

Source: U.S. Department of Energy. Nuclear proliferation and civilian nuclear power. Final report of the Nonproliferation Alternative Systems Assessment Program (NASAP) Vol. II, Proliferation resistance, June 1980, p. 2–41.

INFCE: PRIMER ON THE NUCLEAR FUEL CYCLE

To set the work of INFCE in context it may be helpful to give a brief description of the nuclear fuel cycle.

Nuclear power stations generate electricity from the heat produced when the nuclei of the atoms of heavy material are split. The nuclear reactions that produce the heat in this way take place in a reactor. The heat is then used in a boiler to produce steam to drive conventional turbines.

The material used as the fuel in current nuclear power stations is usually uranium. However, other possible fuel cycles, for example cycles based on thorium, have been considered.

Uranium ore occurs naturally in the earth's crust and is mined by conventional mining techniques. It is then processed into a form suitable for using as fuel in a nuclear reactor. Natural uranium contains two main isotopes, ^{238}U and ^{235}U. Only the nuclei of the ^{235}U atoms are readily fissile, i.e. capable of being split, under most conditions, but ^{235}U accounts for only about 0.7% of natural uranium. Therefore, although some reactors use natural uranium as their fuel, most reactors now use slightly enriched uranium, in which the proportion of ^{235}U atoms has been artificially increased or 'enriched' by ^{235}U taken from a further quantity of natural uranium. Consequently, most of the uranium that is mined is enriched after processing and before it is fabricated into fuel elements for loading into a reactor.

Inside the reactor the fuel is irradiated (i.e. nuclear fission reactions are allowed to take place). The ^{235}U atoms, when split, form lighter elements, known as fission products, some of which are highly radioactive. Some of the ^{238}U atoms are also transformed in the reactor to form heavier elements, also radioactive. The most important of these is plutonium since ^{239}Pu, the isotope of plutonium produced in the largest quantity, is, like ^{235}U, fissile and therefore a potential fuel; indeed some of the plutonium so formed is then subsequently fissioned and releases energy while the fuel remains in the reactor. About one third of the energy released while the uranium fuel is being irradiated comes from the fission of plutonium.

The heat produced by the fission reactions is removed by a cooling agent that passes over the fuel and transfers the heat to the steam circuit which is linked to the turbine. In some types of reactors liquids, such as ordinary (light) water or heavy water, are used as the coolant; in others gases, such as carbon dioxide, are used. The largest number of power reactors currently in operation use light water, and are generically referred to as Light Water Reactors (LWRs). There are two main types of LWR: the Pressurized Water Reactor (PWR) and the Boiling Water Reactor (BWR). But there are also significant numbers of Heavy Water Reactors (HWRs), particularly in Canada, which has developed the CANDU HWR, and of Gas-Cooled Reactors, particularly in France and the UK.

Source: International Nuclear Fuel Cycle Evaluation. INFCE Summary volume. Vienna: 1980, p. 60.

When the spent fuel is discharged from the reactor, it contains unconsumed uranium, fission products, plutonium and some other heavy elements. It generates heat and is radioactive and is placed in storage ponds filled with water to cool. When it has cooled sufficiently it is possible to dissolve the spent fuel and chemically process ('reprocess') it in order to extract the unused uranium and plutonium. These materials can then be fabricated into new fuel elements and recycled to the reactor. When new fuel elements are fabricated in this way they contain a mixture of uranium and plutonium, the plutonium providing the main fissile material in the fuel.

Three different types of fuel cycle are commonly identified depending on whether or not the spent fuel is reprocessed and, if it is, to what type of reactor the uranium and plutonium are recycled:

- In the *once-through fuel cycle*[1] the spent fuel is not reprocessed but kept in storage ponds until it is sent for permanent disposal, for example by conditioning it and burying it underground in a deep geological repository.
- In *thermal*[2] *reactor recycle* the spent fuel is reprocessed and the uranium and plutonium are separated from the fission products which are conditioned, for example by vitrification, and disposed of to a deep geological repository. Both the uranium and the plutonium can then be recycled in new fuel elements to reactors of basically the same type as that in which the plutonium is initially produced. (Alternatively, it is possible to recycle only the uranium and to store the plutonium and vice versa.)
- In *fast*[2] *breeder reactor recycle* the spent fuel is similarly reprocessed and the uranium and plutonium fabricated into new fuel elements. They are, however, recycled to fast breeder reactors (FBRs), in which there is a central core of uranium/plutonium fuel surrounded by a blanket of depleted uranium, i.e. uranium from which most of the ^{235}U atoms have been taken during the process of enrichment of other uranium. This depleted uranium therefore consists mostly of ^{238}U atoms, some of which are converted to plutonium during irradiation.

---

[1] Strictly speaking this method of operation is not a 'cycle' since the unused part of the spent fuel is not recycled.

[2] A 'thermal' reactor is so called because the neutrons that cause fission have been slowed by collision with a light element in the core of the reactor, so that they are in thermal equilibrium with their surroundings (i.e. they are at the same temperature and therefore have a similar kinetic energy, 0.025 eV at room temperature). A 'fast' reactor uses high-energy neutrons (above 0.1 MeV) which have not been slowed down in this way. The word 'fast' does not therefore refer to its capacity to breed plutonium.

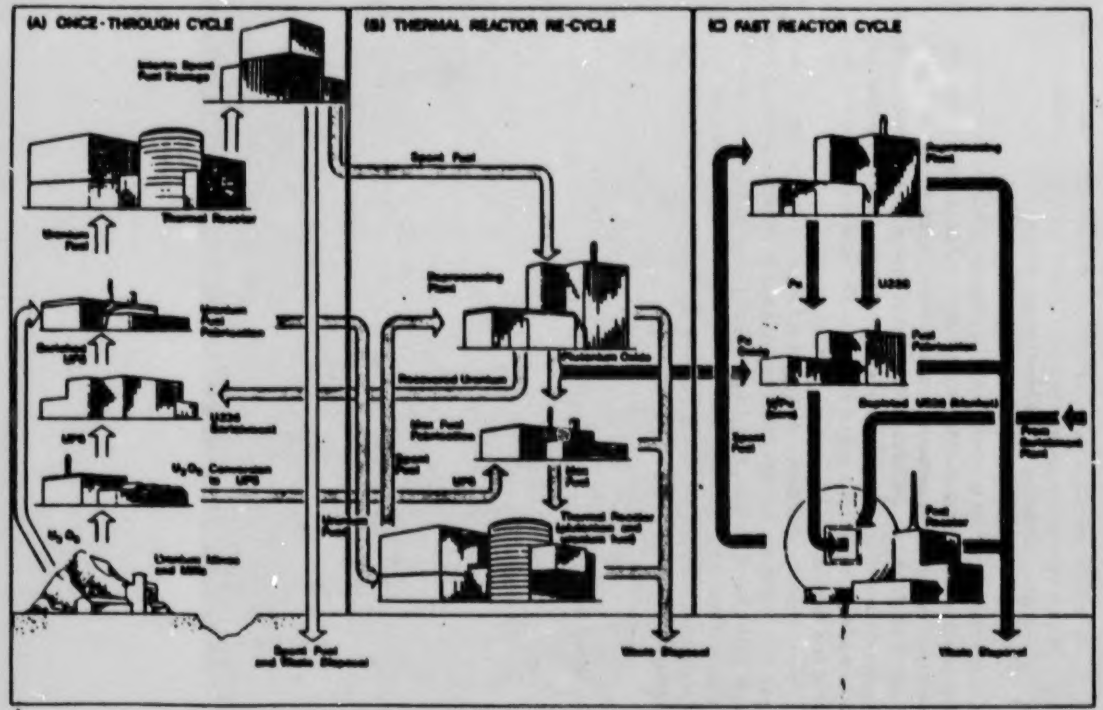

(A) ONCE-THROUGH CYCLE
Interim Spent Fuel Storage
Thermal Reactor
Uranium Fuel
Uranium Fuel Fabrication
Enriched UF6
U235 Enrichment
UF6
U_3O_8 Conversion to UF6
U_3O_8
Uranium Mines and Mills
Spent Fuel and Waste Disposal
(B) THERMAL REACTOR RE-CYCLE
Spent Fuel
Reprocessing Plant
Plutonium Oxide
Recovered Uranium
Mox Fuel Fabrication
Spent Fuel
UF6
Mox Fuel
Thermal Reactor (uranium and plutonium fuel)
Uranium Fuel
Waste Disposal
(C) FAST REACTOR CYCLE
Reprocessing Plant
Pu
U238
Fuel Fabrication
Pu Oxide
Depleted U238 (blanket)
Spent Fuel
Fast Reactor
Waste Disposal

FIG.1. Nuclear fuel cycles.

> By suitable operation, such reactors can produce slightly more plutonium than they consume (hence the name "breeder"), the precise mode of operation depending on the need for plutonium.

Both thermal and fast breeder reactor recycle necessitate facilities for the storage of separated plutonium until required for recycle and arrangements for the transport of plutonium between sites, in addition to reprocessing and fuel fabrication plants and the facilities for the storage or disposal of wastes. Transport of separated plutonium is not necessary if the reprocessing and fuel fabrication plants are located on the same site. A diagrammatic representation of the main fuel cycles is given in Fig. 1.

Research and development programmes are being carried out into all areas of these fuel cycles; for example into improvements to thermal reactors to make more efficient use of uranium, into the recycle of plutonium to thermal and fast reactors, and into the treatment and disposal of radioactive waste or spent fuel. The progress of this work will clearly influence the decisions taken by different countries about their nuclear power programmes.

NUCLEAR FUEL CYCLE REQUIREMENTS IN OECD TO 2000
(Based on the projections taken from the questionnaire replies)

		1983	1984	1985	1990	1995	2000
Installed Capacity (GWe)		158	182	204	277	318	368
Annual U Requirements	(10^3t)	32	34	36	43	49	53
Cumulative U Requirements	(10^3t) (1)	32	66	102	300	530	785
Annual Separative Work Requirements	(10^3t SWU)	20	21	22	29	32	39
Annual Spent Fuel Arisings	(10^3t)	6	6	7	10	11	11
Cumulative Spent Fuel Arisings	(10^3t) (1)	6	12	19	62	114	169
Annual Amounts of Fissile Pu in Spent Fuel	(t fissile Pu)	29	33	37	52	58	63
Cumulative Amounts of Fissile Pu in Spent Fuel	(t fissile Pu)	29	62	99	322	597	900
Minimum Annual Reprocessing Requirements	(10^3t) (2)	1.4	1.4	1.4	1.4	1.1	0.8

1. Since 1983.

2. Amounts of reprocessing required to operate the installed FBRs and based on the 1982 Yellow Book reprocessing philosophy.

Source: Summary of Nuclear Power and Fuel Cycle Data, OECD/NEA, 1985, p. 23.

NUCLEAR REACTORS

CONTENTS

Page

Introduction 327
Glossary (CRS, 1985) 328
General features of nuclear reactors (Glasstone & Sesonske, 1981) 330

Diagrams (OTA 1984):

  Pressurized water reactor 334
  Boiling water reactor 335
  Heavy water reactor 336
  High temperature gas cooled reactor 337

Fuel cycle information (INFCE, 1980):

  Standard light water reactors 338
  LWRs with increased burnup 339
  Heavy water reactors 340
  High temperature reactors 341
Capacity and number of reactors entering service from 1984 onwards, by reactor type (Nuclear Engineering International, 1984) 342
Nuclear generating capacity outside the United States (AIF, 1985) 343
Estimates of total and nuclear electrical generating capacities in OECD countries (OECD, 1985) 344
Capacity projections, by country, for end of 1985 and end of 1990 (IAEA Power Reactor Information System) 345
Research reactors in nonnuclear weapons states (IAEA 1981) 346
World list of nuclear power plants (Nuclear News, February 1985) 350
Nuclear power as a percentage of total electricity generation in selected countries (IAEA, 1985) 366
The pattern of reactor exports (IAEA Power Reactor Information System) 367

NUCLEAR REACTORS

INTRODUCTION

Nuclear reactors harness a self-sustained, controlled chain reaction of fissionable materials (atoms of uranium-233, uranium-235, and plutonium-239) to produce nuclear energy. The amount of energy produced depends upon the amount of nuclear fuel contained in a reactor and the rate of fissioning of atoms of uranium or plutonium.

Power reactors are designed to produce large amounts of heat, usually for transformation into electrical energy. Of the heat energy produced, about 25 to 32 percent is converted into electricity. The rest is lost to the environment. The energy production of a power reactor is expressed as heat in megawats thermal [MWt], or as electricity in megawatts electric [MWe].

Research and experimental reactors are much less powerful than power reactors. Their outputs range from a few watts to 100 MWt. Research reactors are used to bombard materials with neutrons to produce radioisotopes for medical, agricultural, industrial, or research purposes; to study nuclear physics; and to train qualified scientists and technicians in reactor design, operation, and application. Until recently most research reactors have been fueled with highly enriched uranium. However, the use of highly enriched uranium [HEU] fuel in these reactors has caused concern that the HEU might be used to make nuclear weapons. This was one reason given by Israel for its attack on Iraq's research reactor in 1981. Recently the United States has taken the lead in promoting use of low-enriched uranium (uranium enriched to less than 20 percent U-235) in research reactors.

Possession of a research reactor enables a country to train engineers and scientists in working with nuclear materials. Having such a cadre helps a country build and operate nuclear power plants; it also can be useful to a country seeking to produce nuclear weapons materials.

GLOSSARY

Boiling water reactor (BWR): A reactor fueled with low enriched uranium and cooled by water that is allowed to boil as it passes through the core. The boiling water is used directly to produce steam which generates electricity.

Chain reaction: The continuing process of nuclear fissioning in which the neutrons released from a fission trigger at least one other nuclear fission.

Cladding: The term used to describe any material that encloses nuclear fuel. In a water-cooled power reactor this is the fuel rod tube.

Containment: A thick concrete structure surrounding the pressure vessel and other reactor components. It is designed to prevent radioactive material from being released to the atmosphere in the unlikely event that it should escape from the pressure vessel.

Control rods: Long thin rods that are positioned among fuel rods to regulate the nuclear chain reaction. Control rods are composed of material that absorbs neutrons readily. They interrupt or slow down a chain reaction by capturing neutrons that would otherwise trigger more fissions.

Coolant: Fluid that is circulated through the core of a reactor to remove the heat generated by the fission process. In reactors that have more than one coolant system, the fluid which flows through the core is called the "primary coolant" and that which flows through the heat exchanger is called the "secondary coolant."

Fast breeder reactor (FBR): An unmoderated reactor fueled with plutonium or highly enriched uranium and usually cooled by liquid sodium which gives up some of its heat in a heat exchanger to produce steam to generate electricity. The breeder's principal characteristic is that it produces more plutonium than it consumes during operation by transforming uranium-238 into plutonium.

Fuel rod: An assembly consisting of a capped zircalloy or stainless steel tube filled with fuel pellets.

Heavy water reactor (HWR): A reactor fueled with natural uranium and moderated with heavy water which gives up some of its heat in a heat exchanger to produce steam to generate electricity.

High temperature gas cooled reactor (HTGCR): A reactor fueled with either low or highly enriched uranium moderated with graphite and cooled by a gas, usually helium, which gives up some of its heat in a heat exchanger to produce steam to generate electricity.

Light water reactor (LWR): A general term that refers to all nuclear reactors which use ordinary water as a moderator and coolant. This includes pressurized water reactors and boiling water reactors, which are the predominant reactors in the United States.

Moderator: A component (usually water, heavy water, or graphite) of some nuclear reactors that slows neutrons, thereby increasing their chances of being absorbed by a fissile nucleus.

Nuclear steam supply system (NSSS): The basic reactor and support equipment, plus any associated equipment necessary to produce the steam that drives the turbines.

Pressure vessel: A heavy steel enclosure around the core of a reactor. It is designed to withstand high pressures and temperatures to prevent radioactive material from escaping from the core.

Pressurized water reactor (PWR): A reactor fueled with low enriched uranium, moderated and cooled by water kept under pressure to prevent boiling which gives up some of its heat in a heat exchanger to produce steam to generate electricity.

Reactor vessel: The container of the nuclear core. It may be a steel pressure vessel, or a prestressed concrete vessel (PCRV).

Spent fuel storage pool: The pool of demineralized water in which spent fuel elements are stored pending their shipment from the facility.

Spent nuclear fuel: The used nuclear fuel discharged from a reactor is called "spent fuel." To the eye, it is indistinguishable from new fuel. However, it contains intensely radioactive fission products; also about one percent plutonium — depending upon how long it was in the reactor; and residual uranium-238 and U-235.

Steam generator: That part of a power reactor system wherein heat energy from the core is transformed into steam which is then used to drive a turbine generator.

Source: Congressional Research Service, 1985.

GENERAL FEATURES OF NUCLEAR REACTORS

1.58. In spite of numerous variations in the design and components of nuclear reactor systems, there are, nevertheless, a number of general features which all such systems possess in common, to a greater or lesser extent. In outline (Fig. 1.3), a reactor consists of an active *core* in which the fission chain is sustained and in which most of the energy of fission is released as heat. The core contains the nuclear *fuel*, consisting of a fissile nuclide and usually a fertile material in addition. If it is desired, as is often the case, that most of the fissions result from the absorption of slow neutrons, there must also be present a *moderator*. The function of the moderator is to slow down the high-energy neutrons liberated in the fission reaction, mainly as a result of elastic scattering reactions. The best moderators are materials consisting of elements of low mass number with little tendency to capture neutrons; examples are ordinary water, heavy water (deuterium oxide), beryllium, beryllium oxide, and carbon (as graphite). The relative amounts and nature of the fuel and moderator determine the energies of most of the neutrons causing fission.

1.59. The core is surrounded by a neutron *reflector* of a material determined largely by the energy distribution of the neutrons in the reactor. The purpose of the reflector is to decrease the loss of neutrons from the core by scattering back many of those which have escaped. Hence, the use of a reflector results in a decrease in the critical mass of the fissile nuclide. If the core contains a moderator to slow down the neutrons, then the same material (or other moderator) can be used in the reflector. In many commercial power reactors, water serves as the moderator and reflector (and also as the coolant). On the other hand, when it is required that most of the fissions be caused by neutrons of high energy, as it is in some reactors (§1.63), the presence of energy-moderating material must be avoided; the reflector then consists of a dense element of high mass number.

1.60. The heat generated in the reactor core, due to the fissions occurring there, is removed by circulation of a suitable *coolant*. Among the coolants which have been

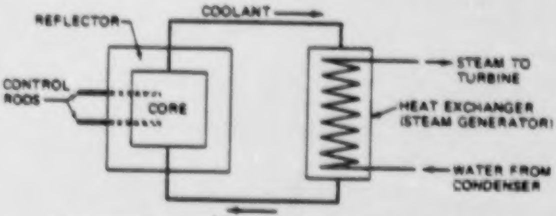


Fig. 1.3. Schematic representation of a nuclear reactor system.

Source: Glasstone, Samuel and Sesonske, Alexander. Nuclear reactor engineering. Third edition. New York: Van Nostrand Reinhold Company, 1981, pp. 19-22.

used are liquid water, liquid sodium (or sodium-potassium alloy), certain organic compounds, and the gases air, carbon dioxide, and helium. If the energy released in the reactor is to be converted into electrical power, the heat must generally be transferred from the coolant to a working fluid to produce steam or a hot gas. The resulting hot vapor or gas can then be used in a conventional turbine-generator system. In some reactors, water is boiled within the reactor core, so that the fission heat is utilized directly to produce steam.

1.61. The higher the temperature of the steam or other working fluid, the greater the efficiency for conversion into useful power. Hence, in a power reactor, it is desirable to operate at the highest practical temperature. Furthermore, in the interests of economy, the specific power of the reactor, i.e., the rate of heat generation per unit mass of fissile material, should be large. As far as nuclear considerations are concerned, there are no limits to the attainable temperature or power level of a nuclear reactor. The practical operating conditions are thus determined by engineering and material limitations, rather than by nuclear factors. Heat must be removed from the core at a rate that permits the coolant to attain a high temperature without the development of such thermal stresses and internal temperatures as to cause the reactor to suffer damage.

1.62. The rate of heat generation is proportional to the nuclear fission rate and this is determined, in a given reactor core, by the neutron density, i.e., the number of neutrons per unit volume. Control, including startup, operation at any desired power level, and shutdown, is thus achieved by varying the neutron density in the core. This is generally done by moving rods of a material that absorbs neutrons readily, i.e., a *neutron poison*. Insertion of a poison, e.g., boron or cadmium, results in a decrease in the reactivity (or neutron multiplying property) of the core and, consequently, in a decrease of the neutron density. Hence, the reactor power level is reduced. Withdrawal of the poison, on the other hand, is accompanied by an increase in the multiplying properties and thus in the neutron density and power level. Some experimental (especially *fast*) reactors have been controlled by displacement of part of the core or reflector; this causes a decrease in the neutron density by allowing some of the neutrons to escape.

REACTOR TYPES

1.63. Nuclear reactors can be classified in various ways, but the most fundamental distinction is that based on the kinetic energy (or speed) of the neutrons causing most of the fissions in the given reactor. Nearly all the neutrons liberated in fission have high energies, and so if the amount of elements of low mass number in the reactor core and reflector is limited, the majority of fissions are produced by fast neutrons. A nuclear reactor in which this is the case is called a *fast reactor*. The fuel material for such reactors must contain a significant proportion—about 15 percent or more—of a fissile nuclide. For the reason given below, the fuel also includes a fertile material.

1.64. In a fast reactor, both the core (fuel) and the reflector, called a *blanket*, contain a fertile material which is converted into a fissile species by neutron capture (§1.41 et seq.). Wasteful (or parasitic) capture of fast neutrons is relatively small, and if the loss of neutrons by escape can be kept to a minimum, more than one neutron will be available, per fission, for the conversion of fertile into fissile nuclei in the core and blanket. Under these circumstances, it is possible for more fissile material to be produced by neutron capture than is consumed. A reactor of this type is called a *breeder* because it is capable of "breeding" fissile material. *Power-breeder reactors*, which may play an increasingly important role in the future, will be capable of producing power and at the same time generating more fissile material than they consume.

1.65. In a true breeder, the fissile nuclide produced is the same as the one consumed, e.g., a fast reactor with plutonium-239 as the fissile species and uranium-238 as the fertile species. An analagous fast reactor is possible with uranium-233 and thorium-232 as the fissile and fertile nuclides, respectively. Breeding of uranium-233 can also be achieved in reactors that do not depend on fast-neutron fissions (§1.68).

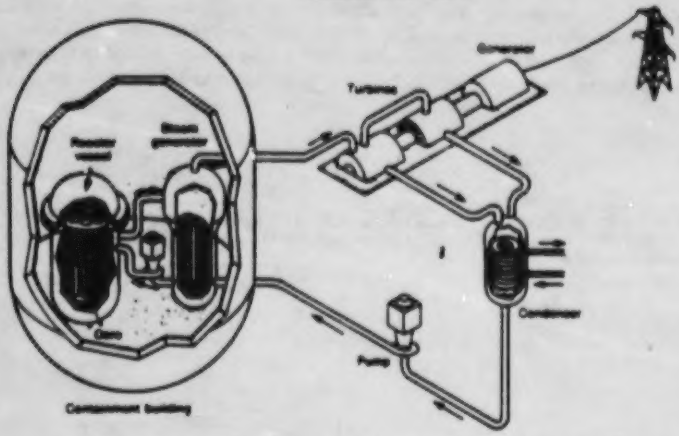
1.66. A fast reactor consuming uranium-235 and producing a larger amount of plutonium-239 (from uranium-238) is a type of breeder, but of less significance than a true breeder. The reserves of uranium-235, the only fissile material existing in nature, are small. Hence, there may ultimately come a time when essentially all the available uranium-235 is exhausted. The further utilization of the remaining uranium-238 and of thorium-232 will then depend on the use of plutonium-239 or uranium-233 to maintain the fission chain. It is for this reason that true breeders, which both produce and consume these fissile nuclides, are of special interest.

1.67. If the reactor core contains a considerable proportion of a moderator, the high energy of the fission neutrons will be rapidly decreased to the thermal region by scattering. Most of the fissions in such a reactor, called a *thermal reactor*, will then be caused by thermal (or slow) neutrons. Thermal reactors have the advantage over fast reactors in greater flexibility of design. There is a reasonable choice of both moderators and coolants, as well as of fuel materials. Depending on the nature of the fuel and moderator, a thermal reactor may be quite small or relatively large.

1.68. In most commercial thermal reactors the fuel is either natural uranium (0.7 percent uranium-235), with heavy water or graphite as the moderator, or uranium containing 2 to 4 percent (average about 2.5 percent) of the fissile isotope, with ordinary water as the moderator. The fuel thus contains a considerable proportion of fertile uranium-238 (or thorium-232 in a few cases). During reactor operation, some of the fertile nuclide is converted into the fissile plutonium-239 (or uranium-233). But, since there is a large probability that slow neutrons in a thermal reactor will be captured in nonfission reactions in fuel and structural materials, and because some neutrons are lost by escape, less than one neutron is available per fission, on the average, for the conversion of fertile into fissile nuclei. Hence, the quantity of plutonium-239 produced in a thermal reactor is usually less than the amount of uranium-235 consumed in maintaining the fission chain. Consequently, it is difficult to design a thermal breeder based on uranium-235 (or plutonium-239) as the fuel.* This situation does not apply, however, when uranium-233 is the fissile material, and so thermal breeders involving this nuclide, with thorium-232 as the fertile species, are possible.

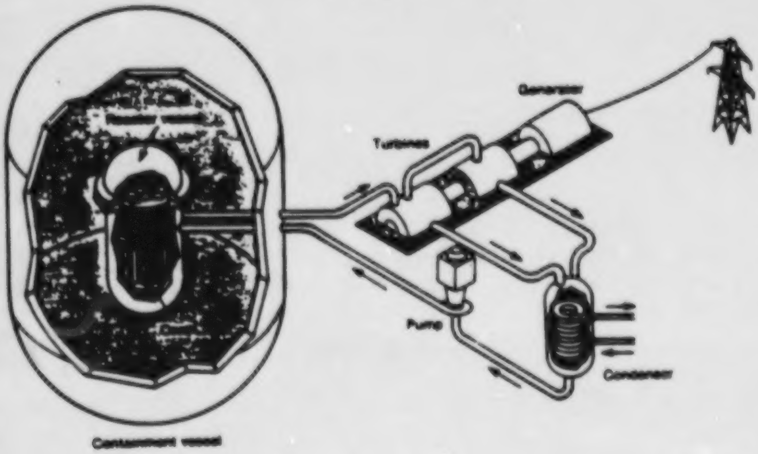
*A thermal breeder of this type is theoretically possible by decreasing the loss of escaping neutrons in a large reactor and taking advantage of the fission of uranium-238 by the fast neutrons which are always present.

Pressurized Water Reactor


Generator
Turbine
Reactor vessel
Steam generator
Core
Condenser
Pump
Containment building

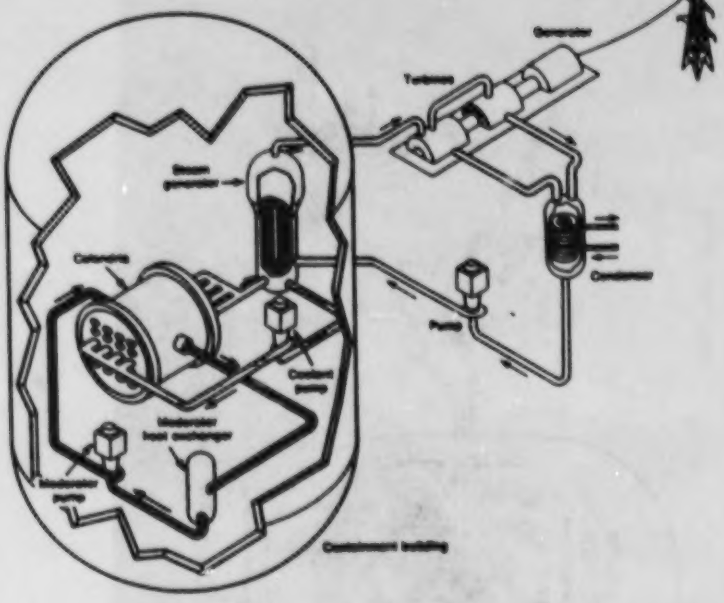
Source: U.S. Congress. Office of Technology Assessment. Nuclear Power in an Age of Uncertainty. U.S. Government Printing Office, 1984, p. 85.

Boiling Water Reactor


Generator
Turbines
Pump
Condenser
Containment vessel

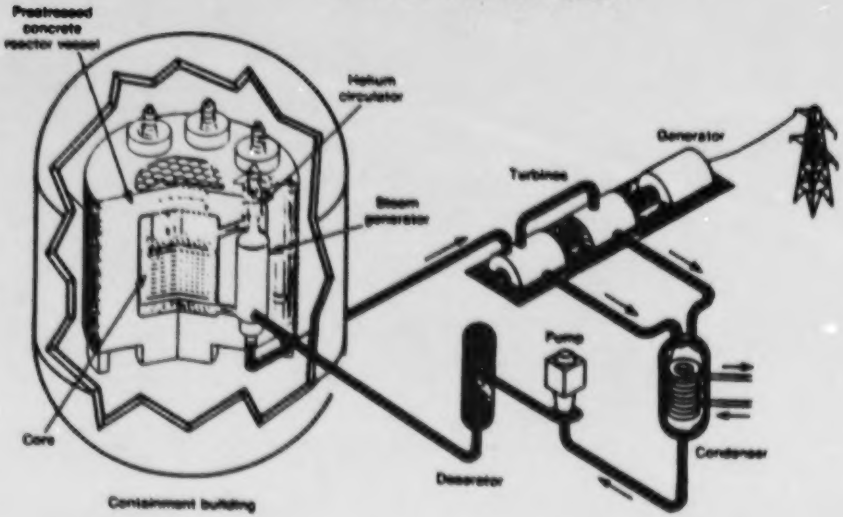
Source: Ibid, p. 86.

Heavy Water Reactor


Generator
Turbines
Steam generator
Calandria
Condenser
Pump
Coolant pump
Moderator heat exchanger
Moderator pump
Containment building

Source: Ibid, p. 98.

High Temperature Gas-Cooled Reactor


Prestressed concrete reactor vessel
Helium circulator
Generator
Turbines
Steam generator
Pump
Condenser
Core
Deaerator
Containment building

Source: Ibid, p. 100

Table 11. Fuel Cycle Information--Standard LWRs

Parameter	PWRs			BWRs	
	France/1	Germany, F.R./2	USA/12	Norway/1	USA/12
Fraction of core replaced/refuelling	0.33	0.33	0.33	0.23	0.22
Refuelling interval (year)	1.07	1	1.07	1	1
Eq[a] reload enrichment (%)	3.1	3.15	3.0	2.721	2.91
Fissile fabrication loss (%)		1.5	1.5	1.5	1.5
Average discharge exposure (MW.d/t)	31800	33000	30390	27500	28440
Peak pellet exposure (MW.d/t)	47000	48000	-	-	<40000
Natural uranium requirements[a,b] (t/GW(e))					
Initial core	324	367	303	430	349
Annual Eq[a] reload	140	138	139	132	146
30-year cumulative					
Gross	4380	4363	4347	4314	4610
Net	-	4224	4193	-	-
SWU requirements[a] (t/GW(e))					
Initial core	227	257	200	278	198
Annual Eq[a] reload	113	111	109	99	114
30-year cumulative[b]					
Gross	3487	3429	3366	3186	3394
Net	-	3318	3278	-	-
Fissile material in spent fuel[a]					
Enrichment (wt % H.E.)					
^{235}U	0.85	0.82	0.85	0.77	0.93
Pu-fiss.	0.68	0.66	0.68	0.57	0.64
Annual Eq[a] discharge (kg/GW(e))					
^{235}U	202	188	205	286	257
Pu-fiss.	168	152	166	153	169
30-year cumulative					
^{235}U	-	6043	6058	6793	8265
Pu-fiss.	-	4795	4813	4575	4877

[a] Normalized to 70% capacity factor and 0.2% tails enrichment.

[b] 30-year net accumulative requirements are 30-year gross cumulative requirements less credit for partially burned last-core fuel.

Source: International Nuclear Fuel Cycle Evaluation (INFCE), Report of Working Group 8, Advanced Fuel Cycle and Reactor Concepts. Vienna: International Atomic Energy Agency, 1980, p. 52.

Table IV. Fuel cycle information—LWRs with increased burnup

Parameter	PWRs			BWRs	
	France/1	Germany, F.R./2	USA/12-A	Norway/1	USA/12-A
Fraction of core replaced/refuelling	0.25	0.25	0.20	0.17	0.13
Refuelling interval (years)	1.07	1	1.07	1	1
Eq^m reload enrichment (%)	3.8	3.82	4.3	3.136	3.79
Fissile fabrication loss (%)		1.5	1.3	1.5	1.3
Average discharge exposure (MW.d/t)	43500	44000	50630	37500	47000
Peak pellet exposure (MW.d/t)	60000	<60000	<63000	-	<76000
Natural uranium requirements[a,b] (t/GW(e))					
Initial core	324	367	314	430	382
Annual Eq^m reload	127	120	123	113	116
30-year cumulative					
Gross	3970	4051	3823	3813	3815
Net	-	3859	3691	-	-
SWU requirements[a,b] (t/GW(e))					
Initial core	227	257	222	178	235
Annual Eq^m reload	111	110	109	93	101
30-year cumulative					
Gross	3425	3431	3372	2991	3130
Net	-	3206	3209	-	-
Fissile material in spent fuel[a,b]					
Enrichment (wt % H.E.)					
^{235}U	0.83	0.80	0.78	0.42	0.66
Pu-Fiss.	0.77	0.71	0.81	0.61	0.77
Annual Eq^m discharge (kg/GW(e))					
^{235}U	147	135	100	83	110
Pu-Fiss.	143	121	112	120	121
30-year cumulative (kg/GW(e))					
^{235}U	-	4409	3136	-	3446
Pu-Fiss.	-	3968	3363	-	3631
Natural uranium savings due to increased burnup (30-year cumulative) (%)					
Gross	9.4	7.2	12.1	11.6	12[c]
Net	-	8.6	12.0	-	

[a] Normalized to 70% capacity factor and 0.2% tails enrichment.

[b] 30-year net cumulative requirements are 30-year gross cumulative requirements less credit for partially burned last-core fuel.

[c] Estimated value for increased burnup; other figures in this column include axial and radial blankets and low-leakage fuel management.

Ibid, p. 60.

Table VII. Fuel Cycle Information - PHWRs

Parameter	Natural U fuelled		Slightly enriched U fuelled				Th/U Fuelled[c]
	Canada/2	Germany, F.R./4	Canada/3	Germany, F.R./4	Romania/1	USA/15	Romania/7
Fuel residence time (efpd)	276	242	790	654	336	813	1920/730
Eq reload enrichment (%)	0.711	0.711	1.2	1.2	0.90	1.2	0/20.0
Fissile fabrication loss (%)	1	1	1	1.5	1	1	-
Average discharge exposure (MW.d/kg)	7.3	7.6	20.9	20.0	14.1	19.75	60/177.0
Peak pellet exposure (MW.d/kg)	-	-	-	-	-	25	-
Natural uranium requirements[a,b] (t/GW(e))							
Initial core	130.0	112	236	150	202	133.1	38/149
Annual eq reload	121.1	118.6	82.3	86.1	96	82	10/72.2
30-year cumulative							
Gross	3716	3600	2651	2679	3000	2539	322/2244
Net	-	3532	-	2569	2880	2466	286/2166
SWU requirements[a,b] (t/GW(e))							
Initial core		-	91.3	26	67	0	0/93
Annual eqm reload	0	-	29.5	31	22.4	29	0/82.9
30-year cumulative							
Gross	0	-	965	930	706	901	0/2496
Net	-	-	-	890	-	861	-
Fissile material in spent fuel[a,b]							
Enrichment (wt% H.E.)							
U-fiss.	0.23	0.21	0.1	0.076	0.15	0.1	1.61/1.78
Pu-fiss.	0.276	0.233	0.366	0.314	0.31	0.347	0/0.362
Annual eq discharge, (kg/GW(e))							
U-fiss	276	263	40.7	31.5	96	41.4	150/27
Pu-fiss.	331	296	140	133	194	139	0/5.6
30-year cumulative (kg/GW(e))							
U-fiss	8216	7350	1267	963	3230	1262	4860/1000
Pu-fiss	9788	8880	6049	3990	5900	4170	0/176

[a] Normalized to 70% capacity factor and 0.2% tails enrichment.

[b] 30-year net cumulative requirements are 30-year gross cumulative requirements less credit for partially burned last-core fuel.

[c] Data refer to ThO_2 bundles and UO_2 cermet fuel bundles, respectively, of which 1140 and 700 bundles, respectively, are replaced per full-power year.

Source: Ibid, p. 72

Table IX. Fuel Cycle Information - HTGRs

	Japan		U.S.A.			Germany, F.R.			U.K.		France[c]		
	LEU		LEU	HEU	HEU	LEU	MEU	HEU	LEU	HEU	LEU	MEU	HEU
	[illegible]	[illegible][d]		current design	optimized								
Fuel residence time	3y	3y	3y	4y	4y	1113d	875d	1211d	1100	1377	4y/3y	4y	4y
Eq[a] reload enrichment (%)	6	6.5	10.1	19.9	19.9	8.5	20	93	7.0	93	12/9.2	21.3	93
Fissile fabrication loss (%)						1	1	1	1.1	1.1	1.2/1.3	1.2	1.2
Average discharge exposure (MW-d/kg)	63	62	111	130	119	100	100	100	100	80	127/97	100	100
Natural uranium requirements[a,b] (t/GW(e))													
Initial core	243	250	186	245	180	170	139	160	225	312			
Annual Eq[a] reload	114	125	118	104	96	100	95	80	90	105			
30-year cumulative													
Gross	3530	3865	3533	3245	2958	3174	2995	2880	3177	3465	3950/3773	3424	3162
Net			3446	3079	2880	3096	2961	2730					
SWU requirements[a,b] (t/GW(e))													
Initial Core	322	238	189	253	212	180	185	218	218	405			
Annual Eq[a] reload	107	119	129	132	111	106	112	115	103	136			
30-year cumulative													
Gross	3318	3689	3880	3827	3601	3370	3323	3642	3305	6496	6272/6058	6058	6183
Net			3783	3649	3313	3200	3472	3339					
Fissile material in spent fuel[a,b]													
Enrichment (%)													
U-fiss./U	1.4	1.6	1.3	6.9	5.0	1.6	6	57	1.05	-	2.4/2.0	5.9	[illegible]
Pu fiss./Pu	60	64	55	69	66	56	39	35	68	-	64.2/57.7	57.4	19
Annual Eq[a] discharge (kg/GW(e))													
U-fiss.	131	130	58	186	97	86	115	133	80	-	120/108	158	190
Pu-fiss.	70	86	65	27	19	57	13	0.4	66	-	86/92	33	1.5
30-year cumulative (kg/GW(e))													
U-fiss.	3930	4500	2136	3800	3579	2320	3444	4804	1812	-			
Pu-fiss.	2370	2580	1423	887	616	1780	392	11	1371	-			

[a] Normalized to 70% capacity factor and 0.2% tails enrichment.

[b] 30-year cumulative requirements are 30-year gross cumulative requirements less credit for partly burned last-core fuel.

[c] Numbers for France at 70% capacity were calculated by the USA.

[d] The characteristics have been optimized to produce fissile material and should not be used in determining once-through performance.

Source: Ibid, p. 80.

Capacity and number of reactors entering service from 1984 onwards

Date	1984		1985		1986		1987		1988		1989		1990		Post 1990	
Type	MWe	No.	MWe	No.	MWe	No.	MWe	No.	MWe	No.	MWe	No.	MWe	No.	MWe	No.
Non-CMEA countries																
PWR	19 135	18	22 877	22	19 066	17	11 140	10	9082	9	10 722	9	6500	7	13 765	13
BWR	7482	7	9504	9	6870	6	1627	2	5037	3	2959	3	—		325	1
PHWR	2250	4	540	1	1710	4	970	2	872	1	800	1	1040	3	2580	4
LMFBR	—		1200	1	—		300	1	—		—		—		300	1
GCR	—		396	1	—		1310	2	1320	2	—		—		—	
Subtotal	28 867	29	34 517	34	27 646	27	15 357	17	16 311	15	14 481	13	7540	10	17 570	19
CMEA countries																
PHWR	—		—		—		—		700	1	700	1	—		—	
PWR	7900	9	6760	9	3880	5	2880	4	1440	2	440	1	440	1	23 000	23
LWGR	2000	2	1500	1	—		—		—		—		—		11 500	9
Total	38 767	40	42 777	44	31 526	32	18 237	21	18 451	18	15 621	15	7980	11	52 070	51

Note: The above table is compiled from the lists of plant under construction together with available data from CMEA countries. In addition to these, the two Egyptian units and one in Pakistan currently subject to negotiation together comprise 2700MWe of PWR capacity which is included in the post 1990 column. Plant types are as follows: PHWR includes all Candu-type reactors of Canadian and Indian design, German PHWRs as supplied to Argentina, and the Japanese Super Fugen advanced thermal reactor. GCR includes the German THTR-300 HTGR project and British AGR plants. For CMEA countries, LWGR (light water cooled, graphite moderated reactor) refers to the channel type reactor so far installed only in the Soviet Union.

Source: Nuclear Engineering International
August, 1984, p. 8.

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NUCLEAR GENERATING CAPACITY OUTSIDE THE UNITED STATES

	1983			1984			1990		1995		2000		2005	
	MWe	% of Capacity	% of Generation	MWe	% of Capacity	% of Generation	MWe	% of Capacity	MWe	% of Capacity	MWe	% of Capacity	MWe	% of Capacity
Argentina	944	8.0	5.4	944	7.8	11.4	1942	12.0	2942	na	3,442	23.0	na	na
Austria	0	0	0	0	0	0	na	na	na	na	na	na	na	na
Belgium	3,467	25.5	45.5	3,467	26.9	48.9	5,486	40.0	na	na	na	na	na	na
Brazil	626	na	na	626	na	na	1,871	na	4,201	na	8,201	na	na	na
Bulgaria	1,760	na	na	1,760	na	na	4,700	25.0	na	na	na	na	na	na
Canada	[illegible]	8.3	11.0	8,617	8.7	12.0	13,183	12.4	14,525	11.8	na	na	na	na
China, People's Republic of	0	0	0	0	0	0	300	na	2,100	na	10,000	na	na	na
Cuba	0	0	0	0	0	0	1,320	na	na	na	na	na	na	na
Czechoslovakia	880	na	na	880	na	na	8,280	na	na	na	na	na	na	na
Denmark	0	0	0	0	0	0	0	0	na	na	na	na	na	na
Egypt, Arab Republic of	0	0	0	0	0	0	0	0	1,800	na	na	na	na	na
Finland	2,160	21.2	41.5	2,280	21.8	41.0	2,260	20.5	3,260	30.0	na	na	na	na
France*	30,530	34.3	48.3	36,000	36.8	57.4	56,823	54.0	66,183	76.0	na	na	na	na
Germany, Democratic Republic of (East)	1,840	na	na	1,840	na	na	5,840	na	na	na	na	50.0	na	na
Germany, Federal Republic of (West)	9,833	11.5	17.8	14,258	15.5	23.0	23,000	26.0	23,000	25.0	24,350	26.0	na	na
Hungary	440	7.0	na	440	na	na	1,760	25.0	2,760	33.0	4,760	45.0	na	na
India	1,095	3.0	na	1,095	3.0	na	1,800	na	4,520	na	7,170	na	9,820	na
Iran	0	0	0	0	0	0	1,200	na	na	na	na	na	na	na
Israel	0	0	0	0	0	0	0	0	1,800	26.0	3,600	40.0	4,600	na
Italy*	1,273	2.5	3.2	1,273	3.4	na	3,273	5.1	13,673	18.4	na	na	na	na
Japan**	18,515	12.0	20.4	19,025	13.5	20.4	34,000	19.0	48,000	23.0	62,000	27.0	na	na
Korea, Republic of (South)	1,916	14.8	18.3	1,916	13.5	na	7,615	na	na	na	na	na	na	na
Libya	0	0	0	0	0	0	na	na	na	na	na	na	na	na
Mexico	0	0	0	0	0	0	1,308	4.1	na	na	5,300	10.0	na	na
Netherlands, The	505	3.5	na	505	3.5	na	505	na	450	na	450	na	450	na
Pakistan	125	2.3	na	125	na	na	125	na	1,525	11.3	4,025	17.7	na	na
Philippines, Republic of the	0	0	0	0	0	0	620	12.8	620	10.2	620	na	na	na
Poland	0	0	0	0	0	0	880	na	1,860	na	na	na	na	na
Portugal	0	0	0	0	0	0	0	0	0	0	1,800	10.0	na	na
Romania	0	0	0	0	0	0	3,000	20.0	na	na	na	na	na	na
South Africa, Republic of	0	0	0	920	1.8	3.4	1,840	8.8	1,840	4.3	1,840	2.4	1,840	1.7
Spain	2,860	na	na	4,800	na	na	8,090	na	na	na	na	na	na	na
Sweden	7,355	24.0	37.0	8,455	23.5	40.8	9,455	na	na	na	na	na	na	na
Switzerland***	1,940	13.8	29.0	1,940	13.8	33.6	2,880	16.0	2,880	16.0	na	na	na	na
Taiwan (Republic of China)	3,114	27.3	[illegible]	4,021	32.4	na	4,926	30.5	6,526	30.0	11,200	44.0	na	na
Thailand	0	0	0	0	0	0	0	0	0	0	600	na	na	na
Turkey	0	0	0	0	0	0	0	0	2,601	10.0	6,000	15.0	na	na
Union of Soviet Socialist Republics	22,140	7.0	na	24,140	na	na	71,048	na	na	na	na	na	na	na
United Kingdom****	8,900	10.0	16.5	8,968	10.7	17.7	12,362	na	na	na	na	na	na	na
Yugoslavia	632	na	na	632	na	na	na	na	na	na	na	na	na	na

*Capacity for 1990 and 1995 includes share of Super Phenix.

**1983 percentage of generation for April 1983 to April 1984. 1984 percentage of generation estimated.

***1984 percentage of generation for October 1983 to September 1984.

****1983 percentage of generation for April 1983 to March 1984.

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Source: Atomic Industrial Forum, 1985 International Survey.

Estimates of Total and Nuclear Electrical Capacities in OECD Countries

[illegible]

	[illegible]			[illegible]			[illegible]			[illegible]			[illegible]			[illegible]			
	Total	Nuclear	% Nuclear	Total	Nuclear	% Nuclear	Total	Nuclear	% Nuclear	Total	Nuclear	% Nuclear	Total	Nuclear	% Nuclear	Total	Nuclear	% Nuclear	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
OECD Total	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	OECD Total (rounded)

1. [illegible]
2. [illegible]
3. [illegible]
4. [illegible]
5. [illegible]
6. [illegible]
7. [illegible]
8. [illegible]
9. [illegible]

Source: Summary of Nuclear Power and Fuel Cycle Data in OECD Member Countries, 1985, pp. 6-7.

CAPACITY PROJECTIONS, BY COUNTRY, FOR END 1985 AND END 1990*

Country	1985		1990	
	Units	MWe	Units	MWe
Argentina	2	935	3	1,627
Belgium	8	5,485	8	5,485
Brazil	1	626	2	1,871
Bulgaria	5	2,585	6	3,538
Canada	19	10,835	23	14,228
China	—	—	1	300**
Cuba	—	—	2	816
Czechoslovakia	6	2,442	10	4,116
Finland	4	2,206	4	2,206
France	48	40,313	61	56,103
Germany DR	5	1,694	5	1,694
Germany FR	21	16,465	27	23,018
Hungary	3	1,224	4	1,632
India	6	1,230	9	1,910
Italy	4	1,267	6	3,231
Japan	34	24,730	38	29,045
Korea Rep. of	7	5,413	9	7,263
Mexico	—	—	2	1,308
The Netherlands	2	501	2	501
Pakistan	1	125	1	125
Phillipines	1	621	1	621
Poland	—	—	1	440
Romania	—	—	2	1,320
South Africa	2	1,842	2	1,842
Spain	8	5,577	8	5,577
Sweden	12	9,455	12	9,455
Switzerland	5	2,882	5	2,882
Taiwan	6	4,924	6	4,924
UK	38	10,104	42	12,556
USA	104	90,018	124	111,382
USSR	52	29,206	82	58,672
Yugoslavia	1	632	1	632
Total	405	273,357	509	370,320

* Only those reactors currently known to be connected to the grid or under construction are considered.

** China hopes to bring Guangdong (two 900 MWe PWRs) on line around 1990.

Source: IAEA Power Reactor Information System.

RESEARCH REACTORS IN NON-NUCLEAR WEAPONS STATES

State	Abbreviated name	Location	Type	Capacity MW(th)
Argentina	RA-1	Constituyentes	Tank	0.07
	RA-2	Constituyentes	MTR	0.00
	RA-3	Ezeiza	MTR	5.00
	RA-4	Rosario	SUR-100	0.00
	RA-6	Bariloche	MTR	5.00
Australia	HIFAR	Lucas Heights, N.S.W.	Tank	11.00
	MOATA	Lucas Heights, N.S.W.	Argonaut	0.01
	CF	Lucas Heights, N.S.W.	Critical assembly	0.00
Austria	SAR	Graz	Argonaut	0.01
	Triga II	Vienna	Pool	0.25
	ASTRA	Seibersdorf	Pool	12.00
Belgium	BR1-CEN	Mol	Tank	4.00
	BR2-CEN	Mol	Tank	100.00
	Thetis	Gent	Pool	0.15
	BR02	Mol	Tank	0.00
	CEN-Venus	Mol	Tank	0.00
Brazil	IEAR-1	São Paulo	Pool	5.00
	UMG	Belo Horizonte	Triga I	0.10
	RIEN-1	Rio de Janeiro	Argonaut	0.01
Bulgaria	IRT-2000	Sofia	Pool	2.00
Canada	NRX	Chalk River, Ont.	HWR	30.00
	NRU	Chalk River, Ont.	HWR	125.00
	WR-1	Pinawa, Manitoba	Organic-cooled	60.00
	McMaster	Hamilton, Ont.	Pool	2.5
	Slowpoke-Toronto	Univ. of Toronto	Pool	0.02
	AECL. Chem. Comp.	Ottawa, Ont.	Pool	0.02
	PTR	Chalk River, Ont.	Pool	0.00
	ZED-2	Chalk River, Ont.	Pool	0.00
	ZEEP	Chalk River, Ont.	Tank	0.00
	Slowpoke - Halifax	Dalhousie Univ.	Pool	0.02
	Ecole Polytechnique	Montreal	Pool	0.02
	Slowpoke - Edmonton	Univ. of Alberta	Pool	0.02
	Slowpoke - Saskatchewan	Saskatoon	Pool	0.02
Chile	La Reina	Santiago	Herald	5.00
	Lo Aguirre	Santiago	MTR	10.00
China, Republic of	THOR	Hsin-chu	Pool	1.00
	TRR	Huaitzupu	HWR	40.00
	ZPRL	Lung-Tan	Pool	0.01
	THAR	Hsin-chu	Argonaut	0.01
	MER	Hsin-chu	Mobile Educational Reactor	0.00
	WBRL	Lung-Tan	Tank	0.1

State	Abbreviated name	Location	Type	Capacity MW(th)
Colombia	IAN-R1	Bogotá	Pool	0.02
Czecho-slovakia	SR-OD	Vochov	Critical assembly	0.00
	SR-OB	Vochov	Exponential assembly	0.00
	VVR-S	Rez	Tank	4.5
	TR-O	Rez	Critical assembly	0.00
Democratic People's Republic of Korea	IRT-DPRK	Nyongbyon	Pool	4.00
	Critical assembly	Nyongbyon	Pool	0.10
Denmark	DR-1	Roskilde	Homogeneous	0.00
	DR-3	Roskilde	Tank	10.00
Finland	Triga II	Otaniemi	Tank	0.25
German Democratic Republic	RFR-S(M)	Rossendorf	Tank	10.00
	RRR	Rossendorf	Argonaut	0.00
	RAKE	Rossendorf	Tank	0.00
	Training Reactor AKR	Dresden	Tank	0.00
	Training and research reactor	Zittau	Tank	0.00
Germany, Federal Republic of[7]	FRM	Garching	Pool	4.00
	GKSS-FRG1	Geesthacht	Pool	5.00
	GKSS-FRG2	Geesthacht	Pool	15.00
	GFK-FR-2	Karlsruhe	Tank	45.00
	KFA-FRJ1	Jülich	Pool	10.00
	KFA-FRJ2	Jülich	Tank	43.00
	Triga	Mainz	Triga I	0.10
	Triga II	Heidelberg	Triga II	0.25
	FMRB	Braunschweig	Tank	1.00
	Triga	Hanover	Triga II	0.25
	Triga	Neuherberg	Triga II	1.00
	GFK-SNEAK	Karlsruhe	Critical assembly	0.00
	SUR 100	Garching	Solid-homogeneous	0.10
	SUR 100	Darmstadt	Solid-homogeneous	0.10
	SUR 100	Stuttgart	Solid-homogeneous	0.10
	SUR 100	Hamburg	Solid-homogeneous	0.10
	SUR 100	Kiel	Solid-homogeneous	0.10
	SUR 100	Ulm	Solid-homogeneous	0.10
	SUR 100	Karlsruhe	Solid-homogeneous	0.10
	SUR 100	Bremen	Solid-homogeneous	0.10
	SUR 100	Furtwang	Solid-homogeneous	0.10
	SUR 100	Aachen	Solid-homogeneous	0.10
	KFA-ITR	Jülich	Critical assembly	0.00
	FRF-2	Frankfurt	Triga	1.0
	SUR 100	Hanover	Solid-homogeneous	0.1
	KFA-MBA	Jülich	Critical assembly	0.00
	BER-2	Berlin (West)	Aqueous Homogeneous	5.00
	SUR 100	Berlin (West)	Solid-homogeneous	0.10
Greece	GRR-1	Athens	Pool	5.00
	N.T.U.	Athens	Graphite	0.00

State	Abbreviated name	Location	Type	Capacity MW(th)
Hungary	WWR-S(M)	Budapest	Tank	5.00
	ZR-4	Budapest	Critical assembly	0.00
	ZR-6	Budapest	Critical assembly	0.00
	Training reactor	Budapest	Tank	0.01
Indonesia	PPTN	Bandung	Triga II	1.00
	Gama	Yogyakarta	Triga II	0.25
a				
Iran	TEPRR	Teheran	Pool	5.00
Iraq	IRT-2000	Baghdad Tuwaitha	Pool	2.00
	Tamuz	Baghdad Tuwaitha	Pool	0.5
Israel b	IRR-1	Soreq	Pool	5.00
Italy	Triga 1-RC1	Casaccia	Triga 1	1.00
	AGN-201	Palermo	Solid-homogeneous	0.00
	CESNEF-L54	Milan	Aqueous Homogeneous	0.01
	ESSOR	Ispra	Tank	40.00
	RTS-1-G.	Pisa	Pool	5.00
	RANA	Casaccia	Pool	0.01
	RITMO	Casaccia	Pool	0.00
	TAPIRO	Casaccia	Fast neutron	0.00
	Triga-2	Pavia	Triga II	0.25
	RB-1	Montecuccolino	Graphite	0.00
	RB-2	Montecuccolino	Argonaut	0.01
	RB-3	Montecuccolino	Tank (D_2O)	0.01
Japan	DCA	Oarai-Machi	Critical assembly	0.00
	FCA	Tokai-Mura	Critical assembly	0.00
	HTR	Kawasaki-shi	Pool	0.10
	JMTR	Oarai-Machi	Tank	50.00
	JMTR-CA	Oarai-Machi	Critical assembly	0.00
	JOYO	Oarai-Machi	FBR	50.00
	JRR-2	Tokai-Mura	Tank	10.00
	JRR-3	Tokai-Mura	Tank	10.00
	JRR-4	Tokai-Mura	Pool	3.50
	Kinki University	Kowaka	UTR-B	0.00
	KUR	Kumatori-cho	Pool	5.00
	NSRR	Tokai-Mura	Triga (pulse)	0.30
	Musashi College of Technology	Kawasaki	Triga II	0.10
	NAIG-CA	Kawasaki-ku	Critical assembly	0.00
	Rikkyo University	Nagasaka	Triga II	0.10
	SHE	Tokai-Mura	Critical assembly	0.00
	TCA	Tokai-Mura	Critical assembly	0.00
	YAYOI	Tokai-Mura	Fast Neutron Source Reactor	0.00
	TTR	Kawasaki-shi	Pool	0.10
	KUCA	Kumatori-cho	Critical assembly	0.00
	KUCA	Kumatori-cho	Critical assembly	0.00
	KUCA	Kumatori-cho	Critical assembly	0.00
Korea, Republic of	KRR - TRIGA II	Seoul	Triga II	0.10
	KRR - TRIGA III	Seoul	Triga III	2.00
	Kyung-Hee Univ.	Seoul	Tank	0.00
Libyan Arab Jamahiriya	IRT-TAJURA	Tajura	IRT	10.00
Mexico	Centro Nuclear de Mexico	Ocoyoacac	Triga III	1.00
	Training reactor facility	Mexico City	SUR 100	0.00

a. India has a large research reactor, CIRUS. It is a 40 MW, natural uranium fueled reactor. It is not covered by IAEA safeguards.
b. Israel has another research reactor, DIMONA, which is a 24 MW natural uranium fueled reactor. It is not under IAEA safeguards.

State	Abbreviated name	Location	Type	Capacity MW(th)
Netherlands	LFR	Petten	Argonaut	0.01
	HOR-THD	Delft	Pool	2.00
	BARN	Wageningen	Graphite	0.10
	HFR	Petten	Tank	45.00
Norway	JEEP-II	Kjeller	Tank	2.00
	HBWR	Halden	HBWR	25.00
Pakistan	PARR	Rawalpindi	Pool	5.00
Peru	RP-O	Lima	Tank	0.00
Philippines	PRR-1	Diliman, Quezon City	Pool	1.00
Poland	EWA	Świerk	Tank	0.00
	Maryla	Świerk	Critical assembly	0.00
	Anna	Świerk	Critical assembly	0.00
	Agata	Świerk	Critical assembly	0.00
	Maria	Świerk	Tank	30.00
Portugal	RPI	Sacavem	Tank	1.00
Romania	VVR-S	Magurele	Tank	10.00
	Triga II	Pitesti-Colibasi	Tank	14.00
	RP-01	Magurele	Tank	0.00
South Africa	SAFARI-1	Pelindaba	Tank	20.00
Spain	JEN-1 and JEN-2	Madrid	Pool	3.00
	CORAL-1	Madrid	Fast cricical assembly	0.00
	ARBI	Bilbao	Argonaut	0.01
	ARGOS	Barcelona	Argonaut	0.01
Sweden	R2	Studsvik	Tank	50.00
	R2-0	Studsvik	Pool	0.00
	R-0	Studsvik	Pool	0.00
Switzerland	Proteus	Würenlingen	Fast thermal critical·assembly	0.00
	Saphir	Würenlingen	Pool	5.00
	Crocus	Lausanne	Pool	0.00
	AGN201P	Geneva	Solid-homogeneous	0.00
	AGN211P	Basel	Pool	0.00
Thailand	TRR-1	Bangkok	Pool	2.00
Turkey	TR-1	Istanbul	Pool	1.00
	TR-2	Istanbul	Triga II	0.25
Uruguay	RU-1	Montevideo	Lockheed	0.10
Venezuela	RV1	Altos de Pipe	Pool	3.00
Yugoslavia	Triga II	Ljubljana	Triga II	0.25
	Boris Kidric R.	Vinča	Tank	6.50
	RB	Vinča	Critical assembly	0.00
Zaire	Triga-Zaire	Kinshasa	Triga II	1.00

Source: IAEA Annual Report for 1981.

nuclear news

World List of Nuclear Power Plants

Operable, Under Construction, or on Order (30 MWe and Over) as of December 31, 1984

	Net MWe	Type	Reactor Supplier	Generator Supplier	Architect Engineer	Constructor	Construction stage (%)	Commercial Operation: orig. scheduled†	Commercial Operation: actual or expected
Argentina									
Comisión Nacional de Energía Atómica (CNEA)									
● Atucha 1 (Lima, Buenos Aires)	335	PHWR	Siemens	KWU	Siemens	Siemens/Imp	100	6/72	6/74
Atucha 2 (Lima, Buenos Aires)	692	PHWR	KWU	KWU	CNEA/KWU	CNEA/KWU	35	6/87	12/88
● Embalse (Embalse, Rio Tercero)	600	CANDU	AECL	Italimpianti	AECL/ Italimpianti	AECL/ Italimpianti	100	1/80	11/83
Austria									
Gemeinschaftskernkraftwerk Tullnerfeld (GKT)									
Tullnerfeld 1 (Zwentendorf)	692	BWR	KWU/ASG	KWU/Elin	KWU	30	100	8/76	indef.*

CONTINUED

● Units in commercial operation

† Estimated date of startup, announced at time reactor was ordered

* Completed but not approved for operation

Twice each year Nuclear News sends a questionnaire to each utility or agency on this list, asking for corrections or additions to the information listed. In cases where a response is not received, we do follow up by phone, though such follow-up is not always possible for plants outside the United States.

The criterion for listing a unit is that either an order or a letter of intent has been signed for the reactor. In cases where the definition of "letter of intent" may be ambiguous, or where a special situation may exist, the judgment of the utility is followed as to whether a plant should be included in the list.

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World List of Nuclear Power Plants, cont'd

	Net MWe	Type	Reactor Supplier	Generator Supplier	Architect Engineer	Constructor	Construction stage (%)	Commercial Operation orig. sched-ule	Commercial Operation actual or ex-pected
Belgium									
Indivision Doel									
● Doel 1 (Antwerp)	390	PWR	ACECOWEN	CDP TOSI ACEC	TE		100	6/73	2/75
● Doel 2 (Antwerp)	390	PWR	ACECOWEN	CDP TOSI ACEC	TE		100	3/75	11/75
Société Belgo-Française d'Energie Nucléaire Mosane (SEMO)									
● Tihange 1 (Huy, Liège)	870	PWR	ACLF	Alsthom Rateau La Meuse ACEC-JS	EdF Electrobel	CFE-Bâtiment ADF SPIE-SNTP C-B	100	12/74	9/75
Société Intercommunale Belge de Gaz et d'Electricité (INTERCOM)									
● Tihange 2 (Huy, Liège)	900	PWR	FRAMACECO	Alsthom Rateau La Meuse ACEC	Electrobel	CTAFMC	100	4/80	6/83
Tihange 3 (Huy, Liège)	1000	PWR	ACECOWEN	Brown Boveri Alsthom ACEC	Electrobel	CTAFMC	95	4/82	6/85
Sociétés Réunies d'Energie du Bassin de l'Escaut (EBES)									
● Doel 3 (Antwerp)	900	PWR	FRAMACECO	Alsthom-Atlantique ACEC	TE	TE	100	2/80	10/82
Doel 4 (Antwerp)	1000	PWR	ACECOWEN	Alsthom-Atlantique ACEC	TE	TE	95	12/82	6/85
Brazil									
Furnas									
● Angra 1 (Itaorna)	626	PWR	W	W	G&H/FE	W	100	3/77	12/84
Angra 2 (Itaorna)	1245	PWR	KWU	KWU	Nuclen	Nuclon	20	12/87	6/90
Angra 3 (Itaorna)	1245	PWR	KWU	KWU	Nuclen	Nuclon	1	12/88	12/91
Bulgaria									
● Kozloduy 1 (Kozloduy)	440	PWR	AEE				100		12/74
● Kozloduy 2 (Kozloduy)	440	PWR	AEE				100		12/75
● Kozloduy 3 (Kozloduy)	440	PWR	AEE				100	/78	12/80
● Kozloduy 4 (Kozloduy)	440	PWR	AEE				100	/79	6/82
Kozloduy 5 (Kozloduy)	1000	PWR	AEE						7/86
Canada									
New Brunswick Electric Power Commission									
● Point Lepreau (Bay of Fundy, N.B.)	640	PHWR	AECL	H-P	AECL/CTL/Utility	Utility	100	10/79	1/83
Ontario Hydro									
● Pickering 1 (Pickering, Ont.)	515	PHWR	AECL	H-P	OH/AECL	OH	100	11/70	7/71
● Pickering 2 (Pickering, Ont.)	515	PHWR	AECL	H-P	OH/AECL	OH	100	10/71	12/71
● Pickering 3 (Pickering, Ont.)	515	PHWR	AECL	H-P	OH/AECL	OH	100	10/72	6/72
● Pickering 4 (Pickering, Ont.)	515	PHWR	AECL	H-P	OH/AECL	OH	100	10/73	6/73
● Bruce 1 (Tiverton, Ont.)	775	PHWR	AECL	H-P	OH/AECL	OH	100	6/77	9/77
● Bruce 2 (Tiverton, Ont.)	775	PHWR	AECL	H-P	OH/AECL	OH	100	9/76	9/77
● Bruce 3 (Tiverton, Ont.)	775	PHWR	AECL	H-P	OH/AECL	OH	100	6/78	2/78
● Bruce 4 (Tiverton, Ont.)	775	PHWR	AECL	H-P	OH/AECL	OH	100	6/79	1/79
● Pickering 5 (Pickering, Ont.)	516	PHWR	AECL	H-P	OH/AECL	OH	100	4/80	3/83
● Pickering 6 (Pickering, Ont.)	516	PHWR	AECL	H-P	OH/AECL	OH	100	1/81	2/84
Pickering 7 (Pickering, Ont.)	516	PHWR	AECL	H-P	OH/AECL	OH	100	10/81	1/85
Pickering 8 (Pickering, Ont.)	516	PHWR	AECL	H-P	OH/AECL	OH	95	7/82	7/85
Bruce 5 (Tiverton, Ont.)	786	PHWR	AECL	CGE	OH/AECL	OH	100	7/83	4/85
● Bruce 6 (Tiverton, Ont.)	786	PHWR	AECL	CGE	OH/AECL	OH	100	10/82	9/84
Bruce 7 (Tiverton, Ont.)	786	PHWR	AECL	CGE	OH/AECL	OH	75	4/84	4/86
Bruce 8 (Tiverton, Ont.)	786	PHWR	AECL	CGE	OH/AECL	OH	60	1/85	1/87

	Net MWe	Type	Reactor Supplier	[illegible] Supplier	[illegible] Engineer	Constructor	[illegible] (%)	Commercial Operation [illegible]	
CANADA cont'd									
[illegible]									
Darlington 1 ([illegible] Twp, Ont.)	881	[illegible]	AECL	[illegible]	OH AECL	OH	23	9.88	2.89
Darlington 2 ([illegible] Twp, Ont.)	881	[illegible]	AECL	[illegible]	OH AECL	OH	46	1.85	5.89
Darlington 3 ([illegible] Twp, Ont.)	881	[illegible]	AECL	[illegible]	OH AECL	OH	3	5.87	11.91
Darlington 4 ([illegible] Twp, Ont.)	881	[illegible]	AECL	[illegible]	OH AECL	OH	1	2.88	8.92
[illegible]									
• Gentilly 2 (Becancour, Que.)	638	[illegible]	AECL	[illegible]	AECL, CTL, HQ	HQ	100	11.79	9.83
China (People's Republic of)									
[illegible]									
[illegible]									
([illegible], Zhejiang Province)	300	PWR	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
Guangdong 1 ([illegible] Bay, Guangdong Province)	[illegible]	PWR							[illegible]
Guangdong 2 ([illegible] Bay, Guangdong Province)	[illegible]	PWR							[illegible]
Cuba									
[illegible] 1 ([illegible])	440	PWR	[illegible]						[illegible]
[illegible] 2 ([illegible])	440	PWR	[illegible]						[illegible]
Czechoslovakia									
• Bohunice 1 ([illegible] Bohunice)	440	[illegible]	[illegible]				[illegible]		[illegible]
• Bohunice 2 ([illegible] Bohunice)	440	[illegible]	[illegible]				[illegible]		[illegible]
• Bohunice 3 ([illegible] Bohunice)	440	[illegible]	[illegible]				[illegible]	[illegible]	[illegible]
Bohunice 4 ([illegible] Bohunice)	440	[illegible]	[illegible]				[illegible]	[illegible]	[illegible]
Dukovany 1 (Dukovany)	440	[illegible]	[illegible]					[illegible]	[illegible]
Dukovany 2 (Dukovany)	440	[illegible]	[illegible]					[illegible]	[illegible]
Dukovany 3 (Dukovany)	440	[illegible]	[illegible]					[illegible]	[illegible]
Dukovany 4 (Dukovany)	440	[illegible]	[illegible]					[illegible]	[illegible]
Mochovce 1 (Mochovce)	440	[illegible]	[illegible]					[illegible]	[illegible]
Mochovce 2 (Mochovce)	440	[illegible]	[illegible]						[illegible]
Egypt									
[illegible] Electricity Authority									
El-Dabaa-1 (El-Dabaa)	[illegible]	PWR					[illegible]	[illegible]	[illegible]
El-Dabaa-2 (El-Dabaa)	[illegible]	PWR					[illegible]	[illegible]	[illegible]
Finland									
Imatran Voima Osakeyhtiö (IVO)									
• Loviisa 1 (Loviisa)	445	PWR	AEE	AEE	IVO	IVO	100	[illegible]	5.77
• Loviisa 2 (Loviisa)	445	PWR	AEE	AEE	IVO	IVO	100	[illegible]	1.81
Teollisuuden Voima Osakeyhtiö (TVO)									
• TVO-1 (Olkiluoto)	710	BWR	ASEA-Atom	Stal-Laval	ASEA-Atom	ASEA-Atom	100	[illegible]	10.79
• TVO-2 (Olkiluoto)	710	BWR	ASEA-Atom	Stal-Laval	ASEA-Atom	Jukola	100	[illegible]	7.82

CONTINUED

• Units in commercial operation

* [illegible]

World List of Nuclear Power Plants, cont'd

	Net MWe	Type	Reactor Supplier	Generator Supplier	Architect Engineer	Constructor	Ownership (%)	Commercial Operation orig. sched.	actual or expected
France									
Centrale Nucléaire Européenne à Neutrons Rapides S.A. (Nersa)									
Creys-Malville (Isère)	1200	LMFBR	Novatome NIRA	Ansaldo	Nersa	[illegible]	100	[illegible]	[illegible]
Électricité de France (EdF)									
• Marcoule G2 (Gard)	40	GCR	SACM	Rateau Alsthom	SACM	CITRA	100		4/59
• Marcoule G3 (Gard)	40	GCR	SACM	Rateau Alsthom	SACM	CITRA	100		5/60
• Chinon 2 (Indre-et-Loire)	210	GCR	[illegible]	Alsthom	EdF CEA	GTM	100		2/65
• Chinon 3 (Indre-et-Loire)	480	GCR	[illegible]	Alsthom	EdF CEA	GTM	100		8/67
• Monts d'Arrée (Finistère)	70	GCHWR	CEA	CEM	[illegible]	C-B	100		7/67
• Saint-Laurent-des-Eaux 1 (Loir-et-Cher)	480	GCR	[illegible]	Alsthom	EdF	GTM	100		3/69
• Saint-Laurent-des-Eaux 2 (Loir-et-Cher)	515	GCR	[illegible]	Alsthom	EdF	GTM	100		8/71
• Bugey 1 (Ain)	540	GCR	[illegible]	Rateau JS	EdF	Dumez	100		4/72
• Phénix (Gard)	233	LMFBR	CEA-EdF-Novatome	CEM	CEA/Novatome	SGE	100		12/73
• Fessenheim 1 (Haut-Rhin)	[illegible]	PWR	Fra	Alsthom	EdF	C-B	100	10/75	10/77
• Fessenheim 2 (Haut-Rhin)	[illegible]	PWR	Fra	Alsthom	EdF	C-B	100	7/76	3/78
• Bugey 2 (Ain)	[illegible]	PWR	Fra	Alsthom	EdF	Bourgeois	100	12/76	2/79
• Bugey 3 (Ain)	[illegible]	PWR	Fra	Alsthom	EdF	Bourgeois	100	6/77	2/79
• Bugey 4 (Ain)	[illegible]	PWR	Fra	Alsthom	EdF	Bourgeois	100	6/78	6/79
• Bugey 5 (Ain)	[illegible]	PWR	Fra	Alsthom	EdF	Bourgeois	100	11/78	1/80
• Dampierre 1 (Loiret)	[illegible]	PWR	Fra	Alsthom	EdF	CM/Sob Ballot	100	7/79	[illegible]
• Dampierre 2 (Loiret)	[illegible]	PWR	Fra	Alsthom	EdF	CM/Sob Ballot	100	1/80	2/81
• Dampierre 3 (Loiret)	[illegible]	PWR	Fra	Alsthom	EdF	CM/Sob Ballot	100	7/80	5/81
• Dampierre 4 (Loiret)	[illegible]	PWR	Fra	Alsthom	EdF	CM/Sob Ballot	100	4/81	11/81
• Gravelines B1 (Nord)	910	PWR	Fra	Alsthom	EdF	SGE	100	4/79	11/80
• Gravelines B2 (Nord)	910	PWR	Fra	Alsthom	EdF	SGE	100	10/79	12/80
• Gravelines B3 (Nord)	910	PWR	Fra	Alsthom	EdF	SGE	100	5/80	6/81
• Gravelines B4 (Nord)	910	PWR	Fra	Alsthom	EdF	SGE	100	2/81	10/81
Gravelines C5 (Nord)	910	PWR	Fra	Alsthom	EdF	SGE	[illegible]	[illegible]	[illegible]
Gravelines C6 (Nord)	910	PWR	Fra	Alsthom	EdF	SGE	[illegible]	[illegible]	[illegible]
• Tricastin 1 (Drôme)	915	PWR	Fra	Alsthom	EdF	C-B-C	100	[illegible]	[illegible]
• Tricastin 2 (Drôme)	915	PWR	Fra	Alsthom	EdF	C-B-C	100	[illegible]	[illegible]
• Tricastin 3 (Drôme)	915	PWR	Fra	Alsthom	EdF	C-B-C	100	[illegible]	[illegible]
• Tricastin 4 (Drôme)	915	PWR	Fra	Alsthom	EdF	C-B-C	100	[illegible]	[illegible]
• Saint-Laurent-des-Eaux B1 (Loir-et-Cher)	[illegible]	PWR	Fra	Alsthom	EdF	GTM	100	[illegible]	[illegible]
• Saint-Laurent-des-Eaux B2 (Loir-et-Cher)	[illegible]	PWR	Fra	Alsthom	EdF	GTM	100	[illegible]	[illegible]
• Blayais 1 (Gironde)	910	PWR	Fra	Alsthom	EdF	SB/Dumez	100	[illegible]	[illegible]
• Blayais 2 (Gironde)	910	PWR	Fra	Alsthom	EdF	SB/Dumez	100	[illegible]	[illegible]
• Blayais 3 (Gironde)	910	PWR	Fra	Alsthom	EdF	SB/Dumez	100	[illegible]	[illegible]
• Blayais 4 (Gironde)	910	PWR	Fra	Alsthom	EdF	SB/Dumez	100	[illegible]	[illegible]
• Chinon B1 (Indre-et-Loire)	870	PWR	Fra	Alsthom	EdF	GTM	100	[illegible]	[illegible]
• Chinon B2 (Indre-et-Loire)	870	PWR	Fra	Alsthom	EdF	GTM	[illegible]	[illegible]	[illegible]
Chinon B3 (Indre-et-Loire)	870	PWR	Fra	Alsthom	EdF	GTM	[illegible]	[illegible]	11/87
Chinon B4 (Indre-et-Loire)	870	PWR	Fra	Alsthom	EdF	GTM	[illegible]	[illegible]	[illegible]
Paluel 1 (Seine-Maritime)	1290	PWR	Fra	Alsthom	EdF	CM/Ballot Chag	100	[illegible]	[illegible]
Paluel 2 (Seine-Maritime)	1290	PWR	Fra	Alsthom	EdF	CM/Ballot Chag	100	[illegible]	[illegible]
Paluel 3 (Seine-Maritime)	1290	PWR	Fra	Alsthom	EdF	CM/Ballot Chag	[illegible]	[illegible]	[illegible]
Paluel 4 (Seine-Maritime)	1290	PWR	Fra	Alsthom	EdF	CM/Ballot Chag	[illegible]	[illegible]	[illegible]
• Cruas 1 (Ardèche)	[illegible]	PWR	Fra	Alsthom	EdF	C-B-C	100	[illegible]	[illegible]
Cruas 2 (Ardèche)	[illegible]	PWR	Fra	Alsthom	EdF	C-B-C	100	[illegible]	[illegible]
• Cruas 3 (Ardèche)	[illegible]	PWR	Fra	Alsthom	EdF	C-B-C	100	[illegible]	[illegible]
Cruas 4 (Ardèche)	[illegible]	PWR	Fra	Alsthom	EdF	C-B-C	100	[illegible]	[illegible]
Saint-Alban 1 (Isère)	1300	PWR	Fra	Alsthom	EdF	Bourgeois	[illegible]	[illegible]	[illegible]
Saint-Alban 2 (Isère)	1300	PWR	Fra	Alsthom	EdF	Bourgeois	[illegible]	[illegible]	[illegible]
Flamanville 1 (Manche)	1300	PWR	Fra	Alsthom	EdF	SGE/SCREG	[illegible]	[illegible]	11/74
Flamanville 2 (Manche)	1300	PWR	Fra	Alsthom	EdF	SGE/SCREG	[illegible]	[illegible]	[illegible]
Cattenom 1 (Moselle)	1300	PWR	Fra	Alsthom	EdF	SB/Dumez	[illegible]	[illegible]	[illegible]
Cattenom 2 (Moselle)	1300	PWR	Fra	Alsthom	EdF	SB/Dumez	[illegible]	[illegible]	[illegible]
Belleville 1 (Cher)	1275	PWR	Fra	Alsthom	EdF	GTM	[illegible]	[illegible]	[illegible]
Belleville 2 (Cher)	1275	PWR	Fra	Alsthom	EdF	GTM	37	[illegible]	[illegible]
Nogent s/Seine 1 (Aube)	1275	PWR	Fra	Alsthom	EdF	CB	42	[illegible]	[illegible]
Nogent s/Seine 2 (Aube)	1275	PWR	Fra	Alsthom	EdF	CB	29	[illegible]	[illegible]
Cattenom 3 (Moselle)	1300	PWR	Fra	Alsthom	EdF	SB/Dumez	25	7/88	[illegible]
Cattenom 4 (Moselle)	1300	PWR	Fra	Alsthom	EdF	SB/Dumez	1	7/88	7/88
Penly 1 (Seine-Maritime)	1300	PWR	Fra	Alsthom	EdF	CM	14	10/88	10/88
Golfech 1 (Tarn et Garonne)	1275	PWR	Fra	Alsthom	EdF	Fougerolle	9	1/90	1/90

FRANCE, cont'd

[illegible]

Germany (Democratic Republic)

[illegible]

Germany (Federal Republic)

[illegible]

CONTINUED

World List of Nuclear Power Plants, cont'd

[illegible]

[illegible]

World List of Nuclear Power Plants, cont'd

[illegible]

South Africa

[illegible]

[illegible]

World List of Nuclear Power Plants, cont'd

[illegible]

Taiwan

[illegible]

United Kingdom

[illegible]

	Net MWe	Type	Reactor supplier	Turbine supplier	Architect-engineer	Constructor	Own-ership share (%)	Commercial operation: orig. sched.	Actual or present est.
UNITED KINGDOM cont'd									
South of Scotland Electricity Board									
• Hunterston A1 (Ayrshire)	150	GCR	GEC	GEC	GEC	Mitchell	100		2/64
• Hunterston A2 (Ayrshire)	150	GCR	GEC	GEC	GEC	Mitchell	100		6/64
• Hunterston B1 (Ayrshire)	625	AGR	TNPG	Par (UK)	TNPG	TNPG	100	2/72	2/76
• Hunterston B2 (Ayrshire)	625	AGR	TNPG	Par (UK)	TNPG	TNPG	100	9/75	3/77
Torness Point 1 (Dunbar, East Lothian)	660	AGR	NNC	GEC	NNC	various	91		4/87
Torness Point 2 (Dunbar, East Lothian)	660	AGR	NNC	GEC	NNC	various	51		4/88
British Nuclear Fuels Ltd.									
• Calder Hall 1 (Cumbria)	50	GCR	UKAEA	Par (UK)	UKAEA	TW	100		10/56
• Calder Hall 2 (Cumbria)	50	GCR	UKAEA	Par (UK)	UKAEA	TW	100		2/57
• Calder Hall 3 (Cumbria)	50	GCR	UKAEA	Par (UK)	UKAEA	TW	100		5/58
• Calder Hall 4 (Cumbria)	50	GCR	UKAEA	Par (UK)	UKAEA	TW	100		4/59
• Chapel Cross 1 (Dumfriesshire)	50	GCR	UKAEA	Par (UK)	UKAEA	TW	100		11/59
• Chapel Cross 2 (Dumfriesshire)	50	GCR	UKAEA	Par (UK)	UKAEA	TW	100		11/59
• Chapel Cross 3 (Dumfriesshire)	50	GCR	UKAEA	Par (UK)	UKAEA	TW	100		11/59
• Chapel Cross 4 (Dumfriesshire)	50	GCR	UKAEA	Par (UK)	UKAEA	TW	100		11/60
United Kingdom Atomic Energy Authority (UKAEA)									
• Winfrith SGHWR (Dorset)	92	HWLWR	UKAEA	AEI-RPL	UKAEA	TurnP	100		1/68
• Dounreay PFR (Highland)	250	LMFBR	UKAEA/TNPG	IE	UKAEA	WFC	100	10/73	6/76
United States									
NORTHEAST									
Baltimore Gas & Electric Co.									
• Calvert Cliffs 1 (Lusby, Md.)	850	PWR	C-E	GE	Bechtel	Bechtel	100	1/73	5/75
• Calvert Cliffs 2 (Lusby, Md.)	845	PWR	C-E	W	Bechtel	Bechtel	100	1/74	4/77
Boston Edison Co.									
• Pilgrim 1 (Plymouth, Mass.)	670	BWR	GE	GE	Bechtel	Bechtel	100	10/71	12/72
Connecticut Yankee Atomic Power Co.									
• Haddam Neck (Haddam Neck, Conn.)	582	PWR	W	W	S&W	S&W	100	11/67	1/68
Consolidated Edison Co.									
• Indian Point 2 (Indian Point, N.Y.)	873	PWR	W	W	UE&C	Wedco	100	6/69	7/74
Duquesne Light Co.									
• Beaver Valley 1 (Shippingport, Pa.)	833	PWR	W	W	S&W	S&W/DLC	100	8/73	4/77
Beaver Valley 2 (Shippingport, Pa.)	833	PWR	W	W	S&W	DLC	[illegible]	10/79	10/86
GPU Nuclear Corporation									
• Oyster Creek 1 (Forked River, N.J.)	620	BWR	GE	GE	B&R/GE	B&R	100	2/68	12/69
• Three Mile Island 1* (Londonderry Twp., Pa.)	792	PWR	B&W	GE	Gilbert	UE&C	100	5/71	9/74
• Three Mile Island 2* (Londonderry Twp., Pa.)	880	PWR	B&W	W	B&R	UE&C	100	5/73	12/78
Long Island Lighting Co.									
Shoreham (Brookhaven, N.Y.)	809	BWR	GE	GE	S&W	Utility	100	/75	10/85
Maine Yankee Atomic Power Co.									
• Maine Yankee (Wiscasset, Me.)	825	PWR	C-E	W	S&W	S&W	100		12/72
New Hampshire Yankee, Inc.									
Seabrook 1 (Seabrook, N.H.)	1150	PWR	W	GE	UE&C	UE&C	[illegible]	11/79	6/86
Seabrook 2 (Seabrook, N.H.)	1150	PWR	W	GE	UE&C	UE&C	[illegible]	5/81	indef.
New York Power Authority									
• Indian Point 3 (Indian Point, N.Y.)	965	PWR	W	W	UE&C	Wedco	100	7/71	8/76
• James A. FitzPatrick (Scriba, N.Y.)	821	BWR	GE	GE	S&W	S&W	100	1/73	7/75
Niagara Mohawk Power Corp.									
• Nine Mile Point 1 (Scriba, N.Y.)	610	BWR	GE	GE	Utility	S&W	100	11/68	12/69
Nine Mile Point 2 (Scriba, N.Y.)	1080	BWR	GE	GE	S&W	S&W	[illegible]	7/78	10/86
Northeast Utilities									
• Millstone 1 (Waterford, Conn.)	660	BWR	GE	GE	Ebasco	Ebasco	100	9/69	12/70
• Millstone 2 (Waterford, Conn.)	870	PWR	C-E	GE	Bechtel	Bechtel	100	4/74	12/75
Millstone 3 (Waterford, Conn.)	1150	PWR	W	GE	S&W	S&W	[illegible]	5/79	5/86
Pennsylvania Power & Light Co.									
• Susquehanna 1 (Berwick, Pa.)	1050	BWR	GE	GE	Bechtel	Bechtel	90	5/79	6/83
Susquehanna 2 (Berwick, Pa.)	1050	BWR	GE	GE	Bechtel	Bechtel	90	5/81	1/85

CONTINUED

NOTE: Removed from this list is Dresden 1. Commonwealth Edison Company announced that this unit, long out of operation, will be cleaned and eventually decommissioned. Also removed from this list are Marble Hill 1 and 2, Hartsville A1 and A2, and Yellow Creek 1 and 2. All of these have been canceled. Please also note that Public Service Company of New Hampshire has changed its name to New Hampshire Yankee.

*Retained on this list are GPU Nuclear's Three Mile Island 1 and 2 units, even though these have long been out of commercial operation.

World List of Nuclear Power Plants, cont'd

	Net MWe	Type	Reactor Supplier	Generator Supplier	Architect Engineer	Constructor	[illegible] (%)	Commercial Operation [illegible]	[illegible]
U.S.—Northeast, cont'd									
Philadelphia Electric Co.									
• Peach Bottom 2 (Peach Bottom, Pa.)	1065	BWR	GE	GE	Bechtel	Bechtel	100	/71	7/74
• Peach Bottom 3 (Peach Bottom, Pa.)	1065	BWR	GE	GE	Bechtel	Bechtel	100	/73	12/74
Limerick 1 (Pottstown, Pa.)	1065	BWR	GE	GE	Bechtel	Bechtel	100	5/75	[illegible]
Limerick 2 (Pottstown, Pa.)	1065	BWR	GE	GE	Bechtel	Bechtel	71	[illegible]	[illegible]
Public Service Electric & Gas Co.									
• Salem 1 (Salem, N.J.)	1079	PWR	W	W	Utility	UE&C	100	/71	6/77
• Salem 2 (Salem, N.J.)	1106	PWR	W	W	Utility	UE&C	100	/73	10/81
Hope Creek 1 (Salem, N.J.)	1067	BWR	GE	GE	Bechtel	Bechtel	94.5	3/75	12/86
Rochester Gas & Electric Corp.									
• Robert E. Ginna (Ontario, N.Y.)	490	PWR	W	W	Gilbert	Bechtel	100	11/69	3/70
Vermont Yankee Nuclear Power Corp.									
• Vermont Yankee (Vernon, Vt.)	514	BWR	GE	GE	Ebasco	Ebasco	100	10/70	11/72
Yankee Atomic Electric Co.									
• Yankee (Rowe, Mass.)	175	PWR	W	W	S&W	S&W	100	1/61	6/61
MIDWEST									
The Cleveland Electric Illuminating Co.									
Perry 1 (North Perry, Ohio)	1205	BWR	GE	GE	Gilbert	Utility	31	[illegible]	[illegible]
Perry 2 (North Perry, Ohio)	1205	BWR	GE	GE	Gilbert	Utility	31	[illegible]	[illegible]
Commonwealth Edison Company									
• Dresden 2 (Morris, Ill.)	794	BWR	GE	GE	S&L	UE&C	100	[illegible]	6/70
• Dresden 3 (Morris, Ill.)	794	BWR	GE	GE	S&L	UE&C	100	[illegible]	10/71
• LaSalle County 1 (Seneca, Ill.)	1078	BWR	GE	GE	S&L	Utility	100	[illegible]	[illegible]
• LaSalle County 2 (Seneca, Ill.)	1078	BWR	GE	GE	S&L	Utility	100	[illegible]	[illegible]
• Zion 1 (Zion, Ill.)	1040	PWR	W	W	S&L	Utility	100	[illegible]	12/73
• Zion 2 (Zion, Ill.)	1040	PWR	W	W	S&L	Utility	100	[illegible]	9/74
Byron 1 (Byron, Ill.)	1120	PWR	W	W	S&L	Utility	[illegible]	[illegible]	[illegible]
Byron 2 (Byron, Ill.)	1120	PWR	W	W	S&L	Utility	[illegible]	[illegible]	[illegible]
Braidwood 1 (Braidwood, Ill.)	1120	PWR	W	W	S&L	Utility	[illegible]	[illegible]	[illegible]
Braidwood 2 (Braidwood, Ill.)	1120	PWR	W	W	S&L	Utility	[illegible]	[illegible]	[illegible]
Commonwealth Edison Company, Interstate Power Company, and Iowa-Illinois Gas and Electric Company									
Carroll County 1 (Savanna, Ill.)	1120	PWR	W		S&L		[illegible]	[illegible]	[illegible]
Carroll County 2 (Savanna, Ill.)	1120	PWR	W		S&L		[illegible]	[illegible]	[illegible]

NORTHEAST: Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont.
SOUTH: Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, West Virginia.
MIDWEST: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, Wisconsin.
SOUTHWEST: Arizona, New Mexico, Oklahoma, Texas.
WEST AND NORTHWEST: California, Colorado, Idaho, Montana, Nevada, Oregon, Utah, Washington, Wyoming.

Northwest
Midwest
Southwest
South

	Net MWe	Type	Reactor Supplier	Generator Supplier	Architect Engineer	Constructor	Construction status (%)	Commercial Operation: orig. schedule date†	Commercial Operation: actual or expected
U.S.—MIDWEST, cont'd									
Commonwealth Edison Co. and Iowa-Illinois Gas & Electric Co.									
• Quad-Cities 1 (Cordova, Ill.)	789	BWR	GE	GE	S&L	UE&C	100	2/70	8/72
• Quad-Cities 2 (Cordova, Ill.)	789	BWR	GE	GE	S&L	UE&C	100	3/71	10/72
Consumers Power Co.									
• Big Rock Point (Charlevoix, Mich.)	63	BWR	GE	GE	Bechtel	Bechtel	100	12/62	12/62
• Palisades (South Haven, Mich.)	757	PWR	C-E	W	Bechtel	Bechtel	100	7/70	12/71
Dairyland Power Cooperative									
• La Crosse BWR (Genoa, Wis.)	50	BWR	AChs	AChs	S&L	Maxon	100	[illegible]	11/69
Detroit Edison Co.									
Fermi 2 (Newport, Mich.)	1100	BWR	GE	GEC	Utility	Daniel	100	3/74	6/85
Illinois Power Co.									
Clinton 1 (Clinton, Ill.)	933	BWR	GE	GE	S&L	Baldwin	98.7	9/80	7/86
Indiana & Michigan Electric Co.									
• Donald C. Cook 1 (Bridgman, Mich.)	1030	PWR	W	GE	AEPSC	AEPSC	100	4/72	8/75
• Donald C. Cook 2 (Bridgman, Mich.)	1100	PWR	W	BBC	AEPSC	AEPSC	100	4/73	7/78
Iowa Electric Light & Power Co.									
• Duane Arnold (Palo, Iowa)	545	BWR	GE	GE	Bechtel	Bechtel	100	12/73	2/75
Kansas Gas & Electric Co., Kansas City Power & Light Co. and Kansas Electric Power Cooperative, Inc.									
Wolf Creek (Burlington, Kans.)	1150	PWR	W	GE	Bech/S&L	Daniel	98.4	4/81	5/85
Nebraska Public Power District									
• Cooper (Brownville, Neb.)	778	BWR	GE	W	B&R	B&R	100	4/71	7/74
Northern States Power Co.									
• Monticello (Monticello, Minn.)	536	BWR	GE	GE	Bechtel	Bechtel	100	5/70	7/71
• Prairie Island 1 (Red Wing, Minn.)	530	PWR	W	W	FPI	Utility	100	8/72	12/73
• Prairie Island 2 (Red Wing, Minn.)	530	PWR	W	W	FPI	Utility	100	8/74	12/74
Omaha Public Power District									
• Fort Calhoun 1 (Fort Calhoun, Neb.)	457	PWR	C-E	GE	G&H	GAP	100	8/71	9/73
Toledo Edison Co.									
• Davis-Besse 1 (Oak Harbor, Ohio)	906	PWR	B&W	GE	Bechtel	Bechtel	100	12/74	11/77
Union Electric Co.									
Callaway 1 (Fulton, Mo.)	1150	PWR	W	GE	Bechtel	Daniel	100	10/81	1/85
Wisconsin Electric Power Co.									
• Point Beach 1 (Two Creeks, Wis.)	497	PWR	W	W	Bechtel	Bechtel	100	4/70	12/70
• Point Beach 2 (Two Creeks, Wis.)	497	PWR	W	W	Bechtel	Bechtel	100	4/71	10/72
Wisconsin Public Service Corporation									
• Kewaunee (Carlton, Wis.)	535	PWR	W	W	PPS	PPS	100	8/72	6/74
SOUTH									
Alabama Power Company									
• Joseph M. Farley 1 (Dothan, Ala.)	829	PWR	W	W	SCS/Bechtel	Daniel	100	4/75	12/77
• Joseph M. Farley 2 (Dothan, Ala.)	829	PWR	W	W	SCS/Bechtel	Daniel	100	4/76	7/81
Arkansas Power & Light Co.									
• Nuclear One 1 (Russellville, Ark.)	836	PWR	B&W	W	Bechtel	Bechtel	100	7/72	12/74
• Nuclear One 2 (Russellville, Ark.)	858	PWR	C-E	GE	Bechtel	Bechtel	100	12/75	3/80
Carolina Power & Light Co.									
• Robinson 2 (Hartsville, S.C.)	665	PWR	W	W	Ebasco	Ebasco	100	3/70	3/71
• Brunswick 1 (Southport, N.C.)	790	BWR	GE	GE	UE&C	Brown	100	3/75	3/77
• Brunswick 2 (Southport, N.C.)	790	BWR	GE	GE	UE&C	Brown	100	3/74	11/75
Shearon Harris 1 (New Hill, N.C.)	900	PWR	W	W	Ebasco	Daniel	95	3/77	9/86
Duke Power Co.									
• Oconee 1 (Seneca, S.C.)	860	PWR	B&W	GE	Utility-Bech	Utility	100	5/71	7/73
• Oconee 2 (Seneca, S.C.)	860	PWR	B&W	GE	Utility-Bech	Utility	100	5/72	9/74
• Oconee 3 (Seneca, S.C.)	860	PWR	B&W	GE	Utility-Bech	Utility	100	9/73	12/74
• McGuire 1 (Cornelius, N.C.)	1180	PWR	W	W	Utility	Utility	100	3/76	12/81
• McGuire 2 (Cornelius, N.C.)	1180	PWR	W	W	Utility	Utility	100	3/77	3/84
Catawba 1 (Clover, S.C.)	1145	PWR	W	GE	Utility	Utility	99	3/79	6/85
Catawba 2 (Clover, S.C.)	1145	PWR	W	GE	Utility	Utility	91.1	3/80	6/87
Florida Power & Light Co.									
• Turkey Point 3 (Florida City, Fla.)	693	PWR	W	W	Bechtel	Bechtel	100	9/70	12/72
• Turkey Point 4 (Florida City, Fla.)	693	PWR	W	W	Bechtel	Bechtel	100	8/71	9/73

CONTINUED

• Units in commercial operation

† Estimated date of startup, announced at time reactor was ordered

World List of Nuclear Power Plants, cont'd

	Net MWe	Type	Reactor Supplier	Generator Supplier	Architect Engineer	Constructor	Construction status (%)	Commercial Operation orig. sched.*	Commercial Operation actual or as planned
U.S.—SOUTH, cont'd									
Florida Power & Light Co., cont'd									
• St. Lucie 1 (Hutchinson Island, Fla.)	802	PWR	C-E	W	Ebasco	Ebasco	100	1/73	12/76
• St. Lucie 2 (Hutchinson Island, Fla.)	802	PWR	C-E	W	Ebasco	Ebasco	100	6/79	8/83
Florida Power Corporation									
• Crystal River 3 (Red Level, Fla.)	825	PWR	B&W	W	Gilbert	Jones	100	9/72	3/77
Georgia Power Co.									
• Edwin I. Hatch 1 (Baxley, Ga.)	810	BWR	GE	GE	SS/Bechtel	Utility	100	4/73	12/75
• Edwin I. Hatch 2 (Baxley, Ga.)	820	BWR	GE	GE	Bechtel	Utility	100	4/78	9/79
Vogtle 1 (Waynesboro, Ga.)	1100	PWR	W	GE	SS/Bechtel	Utility	73	2/78	3/87
Vogtle 2 (Waynesboro, Ga.)	1100	PWR	W	GE	SS/Bechtel	Utility	18	2/79	6/88
Gulf States Utilities Co.									
River Bend 1 (St. Francisville, La.)	940	BWR	GE	GE	S&W	S&W	80	10/79	12/85
Louisiana Power & Light Co.									
Waterford 3 (Taft, La.)	1104	PWR	C-E	W	Ebasco	Ebasco	100	1/77	9/85
Mississippi Power & Light Co.									
Grand Gulf 1 (Port Gibson, Miss.)	1250	BWR	GE	Allis	Bechtel	Bechtel	100	9/79	3/85
Grand Gulf 2 (Port Gibson, Miss.)	1250	BWR	GE	Allis	Bechtel	Bechtel	33	9/81	indef.
South Carolina Electric & Gas Co.									
• Virgil C. Summer 1 (Parr, S.C.)	900	PWR	W	GE	Gilbert	Daniel	100	10/77	1/84
Tennessee Valley Authority									
• Browns Ferry 1 (Decatur, Ala.)	1067	BWR	GE	GE	Utility	Utility	100	10/70	8/74
• Browns Ferry 2 (Decatur, Ala.)	1067	BWR	GE	GE	Utility	Utility	100	10/71	3/75
• Browns Ferry 3 (Decatur, Ala.)	1067	BWR	GE	GE	Utility	Utility	100	10/72	3/77
• Sequoyah 1 (Daisy, Tenn.)	1148	PWR	W	W	Utility	Utility	100	10/73	7/81
• Sequoyah 2 (Daisy, Tenn.)	1148	PWR	W	W	Utility	Utility	100	4/74	6/82
Watts Bar 1 (Spring City, Tenn.)	1177	PWR	W	W	Utility	Utility	99	10/76	10/85
Watts Bar 2 (Spring City, Tenn.)	1177	PWR	W	W	Utility	Utility	88	4/77	4/86
Bellefonte 1 (Scottsboro, Ala.)	1213	PWR	B&W	BBC	Utility	Utility	81	7/77	6/88
Bellefonte 2 (Scottsboro, Ala.)	1213	PWR	B&W	BBC	Utility	Utility	54	4/78	4/91
Virginia Electric & Power Co.									
• Surry 1 (Gravel Neck, Va.)	775	PWR	W	W	S&W	S&W	100	3/71	12/72
• Surry 2 (Gravel Neck, Va.)	775	PWR	W	W	S&W	S&W	100	3/72	5/73
• North Anna 1 (Mineral, Va.)	890	PWR	W	W	S&W	S&W	100	3/74	6/78
• North Anna 2 (Mineral, Va.)	890	PWR	W	W	S&W	S&W	100	7/75	12/80
SOUTHWEST									
Arizona Public Service Co.									
Palo Verde 1 (Wintersburg, Ariz.)	1270	PWR	C-E	GE	Bechtel	Bechtel	100	5/81	late 85
Palo Verde 2 (Wintersburg, Ariz.)	1270	PWR	C-E	GE	Bechtel	Bechtel	99.6	11/82	mid 86
Palo Verde 3 (Wintersburg, Ariz.)	1270	PWR	C-E	GE	Bechtel	Bechtel	95.3	5/84	mid 87
Houston Lighting & Power Company									
South Texas Project 1 (Palacios, Tex.)	1250	PWR	W	W	Bechtel	Ebasco	73	10/80	6/87
South Texas Project 2 (Palacios, Tex.)	1250	PWR	W	W	Bechtel	Ebasco	40	3/82	6/89
Texas Utilities Generating Company									
Comanche Peak 1 (Glen Rose, Tex.)	1150	PWR	W	Allis	G&H	B&R	99	1/80	85
Comanche Peak 2 (Glen Rose, Tex.)	1150	PWR	W	Allis	G&H	B&R	65	1/82	88
WEST AND NORTHWEST									
Pacific Gas & Electric Co.									
Diablo Canyon 1 (Avila Beach, Calif.)	1084	PWR	W	W	Utility	Utility	100	5/72	5/85
Diablo Canyon 2 (Avila Beach, Calif.)	1106	PWR	W	W	Utility	Utility	99	7/74	7/85
Portland General Electric Co.									
• Trojan (Prescott, Ore.)	1130	PWR	W	GE	Bechtel	Imbay	100	9/74	5/76
Public Service Company of Colorado									
• Fort St. Vrain (Platteville, Colo.)	330	HTGR	GA	GE	S&L	GA	100	4/72	1/79
Sacramento Municipal Utility District									
• Rancho Seco (Clay Station, Calif.)	913	PWR	B&W	W	Bechtel	Bechtel	100	5/73	4/75
Southern California Edison and San Diego Gas & Electric Co.									
• San Onofre 1 (San Clemente, Calif.)	436	PWR	W	W	Bechtel	Bechtel	100		1/68
• San Onofre 2 (San Clemente, Calif.)	1100	PWR	C-E	GEC	Bechtel	Bechtel	100	8/73	8/83
• San Onofre 3 (San Clemente, Calif.)	1100	PWR	C-E	GEC	Bechtel	Bechtel	100	6/75	4/84

CONTINUED

World List of Nuclear Power Plants, cont'd

	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
USSR, cont'd									
Ministry of Electric Power, cont'd									
[illegible] 1	1000	PWR							[illegible]
[illegible] 1	1500	LGR						12/86	12/86
Scientific Research Institute for Atomic Reactors									
• VK-50 (Dimitrovgrad)	50	BWR					100		1/66
State Committee on Atomic Energy									
• BN-350 (Shevchenko)	350	LMFBR					100		/73
Yugoslavia									
[illegible] (Slovenia) and [illegible] (Croatia)									
• Krsko (Krsko)	615	PWR	W	W	Gilbert	[illegible]	100	12/76	12/81
Non-U.S. Total ([illegible] units)	[illegible]								
WORLD TOTAL ([illegible] units)	[illegible]								

Abbreviations used in this table

[illegible]

NUCLEAR POWER AS A PERCENTAGE OF TOTAL ELECTRICITY GENERATION IN SELECTED COUNTRIES

France	58.7	Hungary	22.2
Belgium	50.8	Spain	19.3
Finland	41.1	UK	17.3
Sweden	40.6	USA	13.5
Switzerland	36.5	Canada	11.6
Bulgaria	28.6	USSR	9.0
F. R. Germany	23.2	Czechoslovakia	8.5
Japan	22.9	Netherlands	5.8

Source: IAEA. Press Release PR. 85/5.

THE PATTERN OF REACTOR EXPORTS*

Country	To industrialised and CMEA countries		To developing countries	
	Units	GWe	Units	GWe
United States	60	27.8	18	12.7
FR Germany	4	3.3	3	2.3
Canada	2	1.3	5	1.8
France	9	5.0	2	1.8
Sweden	2	1.3	—	—
Britain	2	0.3	--	--
Soviet Union	30	13.7	2	0.8

*For reactors in operation or under construction at end 1983.

Source: IAEA Power Reactor Information System.

URANIUM SUPPLY AND DEMAND

CONTENTS

Page
Introduction 371

NEA/IAEA report, 1983:

Reasonably assured resources 372
Estimated additional resources—category I 373
Estimated additional resources—category II 374
Geographical distribution of uranium resources 375
High cost—$130-$260/kg U resources 376
Uranium production 377
Short term uranium production capability projections 378
Annual reactor uranium requirements 379
Main exporters and importers of uranium in WOCA 380
Annual production requirements (Uranium Institute, 1984) 381
Future uranium requirements (Uranium Institute, 1984) 382

DOE, 1984:

Projected U.S. nuclear power capacity and uranium requirements 383
Foreign WOCA nuclear power capacity and uranium requirements 384

URANIUM SUPPLY AND DEMAND

INTRODUCTION

The balance between uranium supply and demand by affecting the price of uranium can have an indirect but important effect on proliferation. If the demand for uranium exceeds the supply, the resulting upward pressure on uranium prices will increase short-term pressures to produce and use plutonium as a supplementary nuclear fuel for conventional nuclear power plants. Conversely, if the supply of uranium exceeds demand, prices will tend to fall, decreasing incentives to use plutonium. Since the late 1970's there has been a surplus of uranium and substantial excess enrichment capacity, and uranium is seen as a more economical nuclear fuel than plutonium. This situation is likely to continue for many years. Nevertheless, some countries which are dependent on uranium imports have argued that future political trade barriers or supply shortages could cause them to develop and use plutonium.

REASONABLY ASSURED RESOURCES

(1,000 Tonnes U)

Data Available 1st January, 1983
(NEA/IAEA 1983)

COUNTRIES COST RANGE	$80/kg U (reserves)	$80-130/kg U	TOTAL
Algeria[2,3]	26	—	26
Argentina [2]	18.8	4.5	23.3
Australia[3]	474	64	538
Austria[3]	0	0.3	0.3
Brazil[1]	163.3	—	163.3
Cameroon, Republic of	0	0	0
Canada	176	9	185
Central African Republic[1,4]	18	—	18
Chile[*1]	0	2.3	2.3
Denmark	0	27	27
Egypt	0	0	0
Finland[1]	0	3.4	3.4
France	56.2	11.3	67.5
Gabon	18.7	4.7	23.3
Germany, Federal Republic of	0.9	4.2	5.1
Greece	0.4	5	5.4
India	31.7	10.9	42.6
Italy	2.9	—	2.9
Japan	7.7	—	7.7
Korea, Republic of	0	10	10
Mexico[1]	2.9	—	2.9
Namibia[5]	119	16	135
Niger[1,5]	170.4	—	170.4
Peru[1]	0.5	—	0.5
Portugal	6.7	1.5	8.2
Somalia [1,4]	0	6.6	6.6
South Africa	191	122	313
Spain	15.7	4.5	20.2
Sweden[6]	2	37	39
Turkey[1]	2.5	2.1	4.6
United States of America	131.3	275.9	407.2
Zaire[1,5]	1.8	—	1.8
TOTAL (rounded)	1,838	417	2,255
TOTAL (adjusted)[7]	1,623	373	2,000

Reported tonnages refer to quantities of uranium recoverable from mineable ore, except where noted.

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[*] Assigned to cost category by Secretariat.

[1] Uranium contained in-situ.

[2] Uranium contained in mineable ore.

[3] OECD(NEA)/IAEA: "Uranium Resources, Production and Demand", Paris, 1977.

[4] OECD(NEA)/IAEA: "Uranium Resources, Production and Demand", Paris, 1979.

[5] OECD(NEA)/IAEA: "Uranium Resources, Production and Demand", Paris, 1982.

[6] Includes 35,000 tonnes U in the Ranstad deposit from which no uranium production is allowed due to a veto by local authorities for environmental reasons.

[7] Adjusted by the Working Party to account for mining and milling losses not incorporated in certain estimates.

Source: Uranium resources, production and demand. A joint report by the OECD Nuclear Energy Agency and the International Atomic Energy Agency. December, 1983. Paris: OECD, p. 19.

ESTIMATED ADDITIONAL RESOURCES - CATEGORY I
(1,000 Tonnes U)

Data available 1st January, 1983
(NEA/IAEA 1983)

COUNTRIES	COST RANGE $80/kg U	$80-130/kg U	TOTAL
Algeria	—	—	—
Argentina[2]	7	—	7
Australia	235	128	363
Austria[3]	0.7	1.0	1.7
Brazil[1]	92.4	—	92.4
Cameroon, Republic	0	1.2	1.2
Canada	161	68	229
Central African Republic	—	—	—
Chile*[4]	0	2.3	2.3
Denmark	0	16	16
Egypt[1,4]	0	5	5
Finland[1]	—	—	—
France	26.6	6.25	32.9
Gabon	1.3	8.3	9.6
Germany, Federal Republic of	1.3	6.9	8.2
Greece	6	0	6
India	4.8	14.6	19.3
Italy	—	1	1
Mexico[1]	3.5	2.6	6.1
Namibia[3]	30	23	53
Niger[2,3]	283.6	—	283.6
Peru	—	—	—
Portugal	1	—	1
Somalia[1,4]	0	3.4	3.4
South Africa	99	48	147
Spain	5	—	5
Sweden[6]	0.3	43	43.3
Turkey	—	—	—
United States of America	30.4	52.2	82.6
Zaire[2,3]	1.7	—	1.7
TOTAL (rounded)	1,011	411	1,421
TOTAL (adjusted)	885	305	1,190

Reported tonnages refer to quantities of uranium recoverable from mineable ore, except where noted.

* Assigned to cost category by Secretariat.

1 Uranium contained in-situ.

2 Uranium contained in mineable ore.

3 OECD(NEA)/IAEA: "Uranium Resources, Production and Demand", Paris, 1977.

4 OECD(NEA)/IAEA: "Uranium Resources, Production and Demand", Paris, 1979.

5 OECD(NEA)/IAEA: "Uranium Resources, Production and Demand", Paris, 1982.

6 Includes 40,000 tonnes U in the Ranstad deposit from which no uranium production is allowed due to a veto by local authorities for environmental reasons.

7 Adjusted by the Working Party to account for mining and milling losses not incorporated in certain estimates.

Source: Ibid., p. 20.

ESTIMATED ADDITIONAL RESOURCES - CATEGORY II
(1,000 Tonnes U)

Data available 1st January, 1983
NEA/IAEA 1983

$ COST RANGE COUNTRIES	<$80/kg U	$80-130/kg U	TOTAL
Argentine	3.8	9.4	13.2
Canada[1]	179	102	281
France	0	12.2	12.2
Gabon	---	1.2	1.2
Germany, Federal Republic of	2.5	2.5	5
Greece	---	6	6
Portugal	1.5	---	1.5
United Kingdom	0	2	2
United States of America[1]	470.6	338.5	809.1

These quantities are expressed in terms of tonnes of uranium contained "in situ" except were noted.

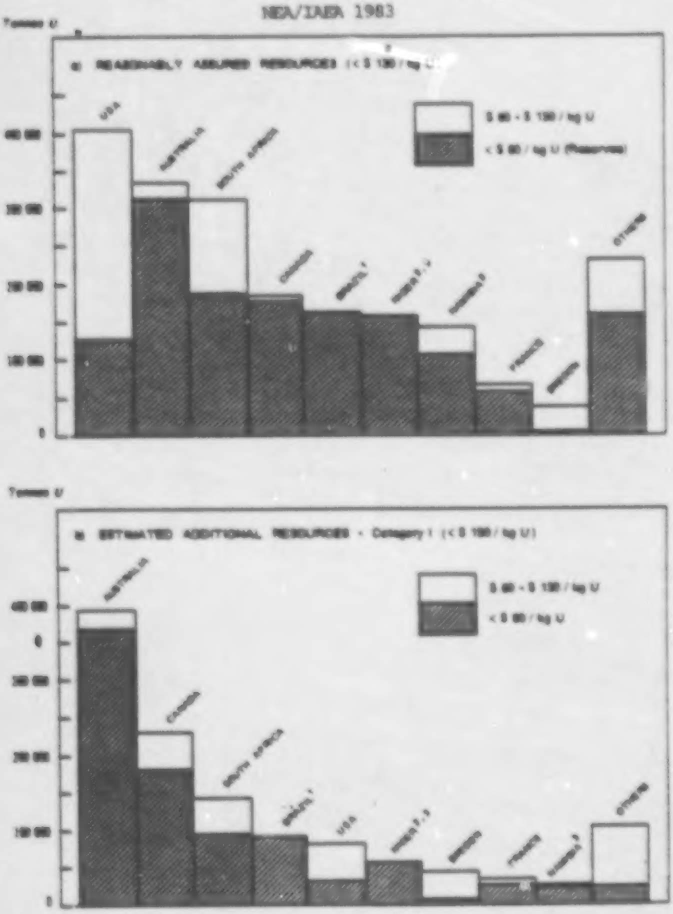
1. Uranium contained in mineable ore.

Note. Category II resources are those producable at costs of $130.kg U or less.

Source. Ibid., p. 23.

GEOGRAPHICAL DISTRIBUTION OF URANIUM RESOURCES

NEA/IAEA 1983



1. Uranium contained in situ.
2. Uranium contained in mineable ore.
3. OECD(NEA) / IAEA "Uranium Resources, Production and Demand" Paris, 1982.

Source. Ibid., p. 22.

HIGH COST - $130-$260/kg U - RESOURCES
(1,000 tonnes U)

Data available 1st January, 1983
(NEA/IAEA 1983)

COUNTRIES	RAR	EAR-I	EAR-II	SR
Argentina	2.6	---	7.2	---
Cameroon, Republic of	---	4	---	4
Canada	69	58	187(1)	(See Table 4(a)
Denmark	---	---	---	50
France	---	---	---	6.8
Italy	4.9	4.8	---	---
Namibia[2]	9	15	---	---
South Africa	92	357	---	---
United Kingdom	---	---	5.4	14.8
United States	241.3	76.3	477(1)	595(1)

Unless otherwise noted RAR and EAR-I are reported in quantities of uranium recoverable from mineable ore, EAR-II and SR are in quantities of uranium contained "in situ".

1. Uranium contained in mineable ore.

2. OECD(NEA/IAEA: "Uranium Resources, Production and Demand", Paris, 1982.

Source: Ibid., p. 27.

URANIUM PRODUCTION
(Tonnes U)
(NEA/IAEA 1983)

COUNTRY	PRE-1977	1977	1978	1979	1980	1981	1982	1983[1]
Argentina	330	98	109	136	187	123	135	200
Australia	8,159	356	516	705	1,561	2,860	4,453	3,700
Belgium[2]	0	0	0	0	20	40	40	40
Brazil	0	0	0	0	0	4	290	300
Canada	112,080[3]	5,790	6,800	6,820	7,150	7,720	8,080	7,500
Finland	30	0	0	0	0	0	0	0
France	23,133	2,097	2,183	2,362	2,634	2,553	2,859	3,200
Gabon	8,464	907	1,022	1,100	1,033	1,022	970	1,042
Germany, Federal Republic of	151[4]	15	35	25	34	36	34	40
Japan	38	3	2	2	5	3	5	7
Namibia	594	2,340	2,697	3,840	4,042	3,971	3,776	3,800[5]
Niger	6,108	1,609	2,060	3,615	4,132	4,363[6]	4,252[6]	3,400
Portugal	1,932	95	98	114	82	102	113	100
South Africa	75,332	3,340	3,961	4,797	6,146	6,131	5,816	5,800
Spain	476	177	191	190	190	178	150	150
Sweden	200	0	0	0	0	0	0	0
United States of America	209,800	11,500	14,200	14,408	16,804	14,793	10,331	7,900[7]
Zaire	25,600[3]	0	0	0	0	0	0	0
TOTAL	472,436	28,347	33,874	38,112	44,120	43,895	41,324	41,400

1. Estimated.
2. Uranium from improted phosphates.
3. Pre-1938 data not available.
4. Plus 120 tonnes uranium of foreign origin.
5. Secretariat Estimate.
6. CEA - Rapport Annuel (1981, 1982).
7. Production in the US in 1983 is expected to fall between 7,500 and 8,300 tonnes.

Source: Ibid., p. 30.

SHORT TERM URANIUM PRODUCTION CAPABILITY PROJECTIONS*

(Tonnes U)

NEA/IAEA 1983

Country	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Argentina	340	340	380	120	120	120	120	120	180	180	180	120
Australia[1]	3,800	3,800	3,800	3,000	2,900	3,300	3,300	4,500	4,500	5,000	5,000	5,000
Belgium[2]	40	40	40	40	40	40	40	40	40	40	40	40
Brazil	420	420	420	420	420	420	420	420	420	420	480	420
Canada	10,900	11,500	12,000	12,200	12,200	12,100	12,100	12,000	11,700	11,500	11,000	9,900
France	3,900	3,900	3,900	3,900	3,900	3,900	3,900	3,900	3,900	3,900	3,900	3,900
Gabon[3]	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500
Germany, Federal Republic of	40	40	40	40	40	40	40	40	40	40	-	-
India[4]	200	200	200	200	200	200	200	200	200	200	200	200
Italy	0	0	0	0	0	0	0	0	0	0	0	230
Japan	9	9	9	9	9	9	9	-	-	-	-	-
Mexico[4]	0	0	0	0	240	240	240	240	240	240	240	240
Namibia[4]	3,900	3,900	3,900	3,900	3,900	3,900	3,900	3,900	3,900	3,900	3,900	3,900
Niger[4]	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000
Portugal	115	115	170	170	170	170	170	170	170	170	170	170
South Africa	6,134	6,305	6,045	6,045	6,530	6,463	6,463	6,463	6,463	6,296	6,296	6,118
Spain	150	150	150	380	870	735	735	735	735	750	730	735
United States of America	10,300	10,400	10,900	11,300	11,700	12,000	12,200	13,300	13,200	13,200	14,000	14,000
TOTAL	45,348	46,060	46,034	47,004	48,139	48,957	49,357	51,340	51,140	51,270	51,350	50,501

* Based on Existing and Committed production centres and RAR + EAR-I recoverable at costs of $ 130/kg U or less.

1. These figures relate to technical capability and could be affected by decisions yet to be taken either by the mining companies involved and/or by the Government following the ASTEC Inquiry into Australia's role in the nuclear fuel cycle (refer to Australian section on National Policies relating to Uranium). They include estimates of production for the Olympic Dam Project at Roxby Downs which is still at the planning stage. The joint venturers have until 31 December 1984 to complete feasibility studies and until 31 December 1987 in which to take a decision in respect of further development of the project. The Government has decided that if a commercial decision to proceed with the development of Olympic Dam were made it will permit exports of uranium from that mine subject to whatever safeguards arrangements apply at the time of export.
2. Uranium from imported phosphates. 3. Secretariat estimate from 1991-1995 4. Secretarial estimate

Source: Ibid. p. 38.

ANNUAL REACTOR URANIUM REQUIREMENTS

(Tonnes U)
NEA/IAEA 1983

Country	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Argentine	170	140	122	158	247	257	337	337	331	361	371	504	572
Belgium	700	750	950	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Brazil	108	108	108	649	272	848	472	507	671	707	1,248	871	906
Canada	1,400	1,500	1,600	1,800	1,850	1,950	2,050	2,150	n.r.	n.r.	n.r.	n.r.	2,300
Finland	350	350	350	350	350	350	350	350	350	350	480	480	480
France	6,500	6,700	6,900	7,100	7,300	7,500	7,800	8,000	8,200	8,400	8,600	8,800	9,000
Germany, Federal Republic of	2,700	2,800	3,200	3,400	3,500	3,400	3,600	3,800	4,000	4,200	4,400	4,500	4,700
Italy	270	700	700	270	424	982	1,344	1,344	1,514	2,258	1,386	1,726	2,236
Japan	n.r.	n.r.	5,300	n.r.	n.r.	n.r.	n.r.	12,000	n.r.	n.r.	n.r.	n.r.	14,000
Korea *	470	670	980	1,110	940	1,090	1,090	1,090	1,090	1,090	1,090	1,090	1,090
Libya	-	-	-	-	-	-	-	50	20	20	70	40	40
Netherlands	100	100	100	100	100	100	100	100	100	100	100	100	100
Philippines	-	-	450	150	150	150	150	150	150	150	150	150	150
South Africa	165	209	209	209	209	209	209	209	209	209	209	209	209
Spain	707	823	734	1,387	1,902	1,481	2,068	1,990	1,803	1,676	n.r.	n.r.	n.r.
Sweden	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300
Switzerland	350	570	570	570	570	570	570	700	700	700	700	700	700
United Kingdom	1,500	1,550	2,300	2,400	1,850	1,950	1,550	1,400	1,400	1,200	1,200	1,200	1,200
United Kingdom (high)	1,500	1,550	2,300	2,400	1,850	1,950	1,550	1,750	2,300	2,900	3,450	4,000	4,550
United States	13,100	12,300	11,600	14,100	14,500	13,400	15,000	16,200	15,000	14,900	16,400	16,700	16,900
Rest of WOCA**	n.e.	n.e.	1,500	n.e.	n.e.	n.e.	n.e.	2,000	n.e.	n.e.	n.e.	n.e.	2,500

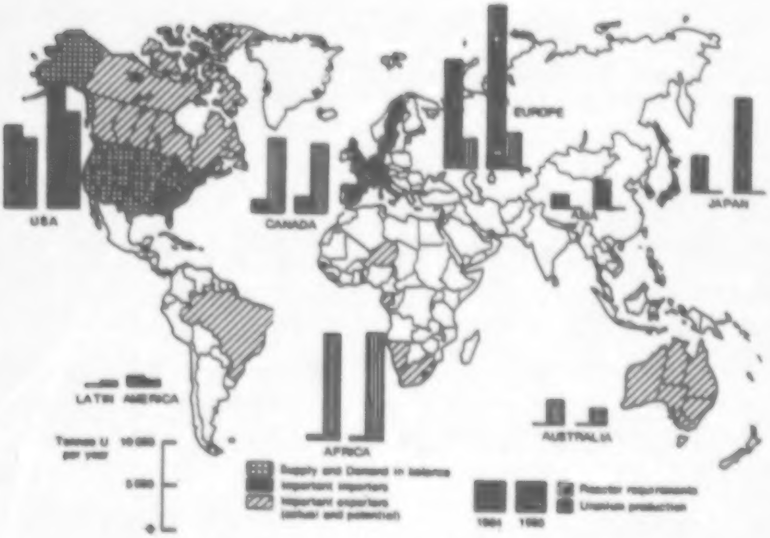
* Requirements projected but not ordered as of 1.1.83 not included.

** Estimated by the Secretariat.

nr = not reported
ne = not estimated

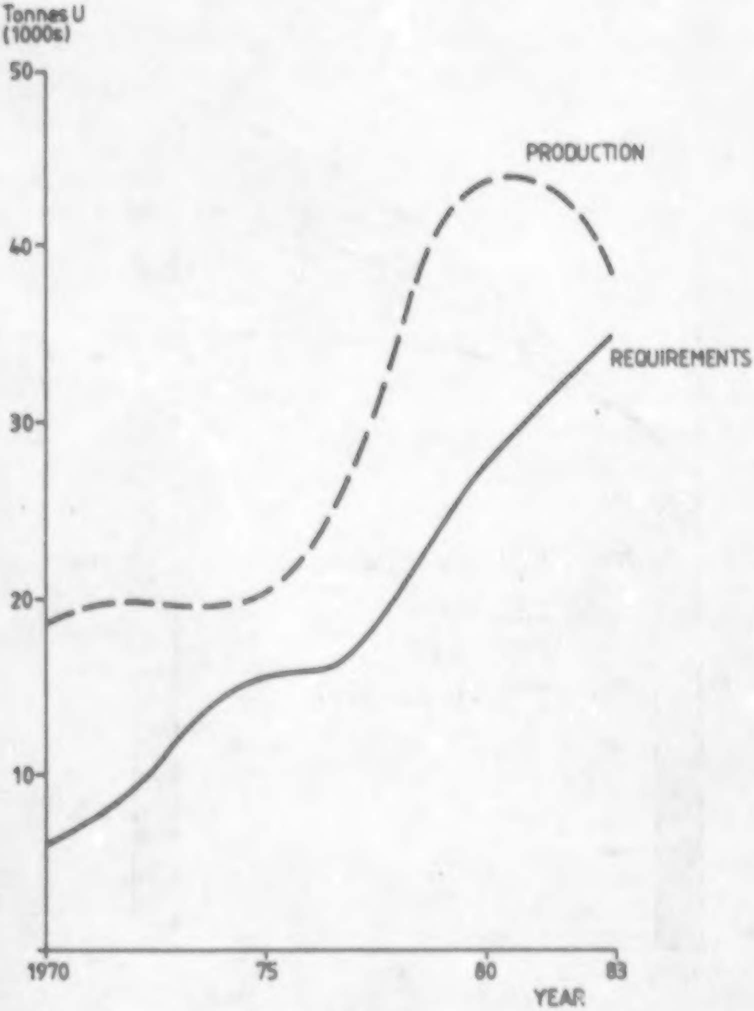
Source: Ibid. p. 40.

MAIN EXPORTERS AND IMPORTERS OF URANIUM IN WOCA


USA
CANADA
EUROPE
ASIA
JAPAN
LATIN AMERICA
AFRICA
AUSTRALIA
Tonnes U per year
10 000
5 000
0
Supply and Demand in balance
Important importers
Important exporters (actual and potential)
1984
1990
Reactor requirements
Uranium production

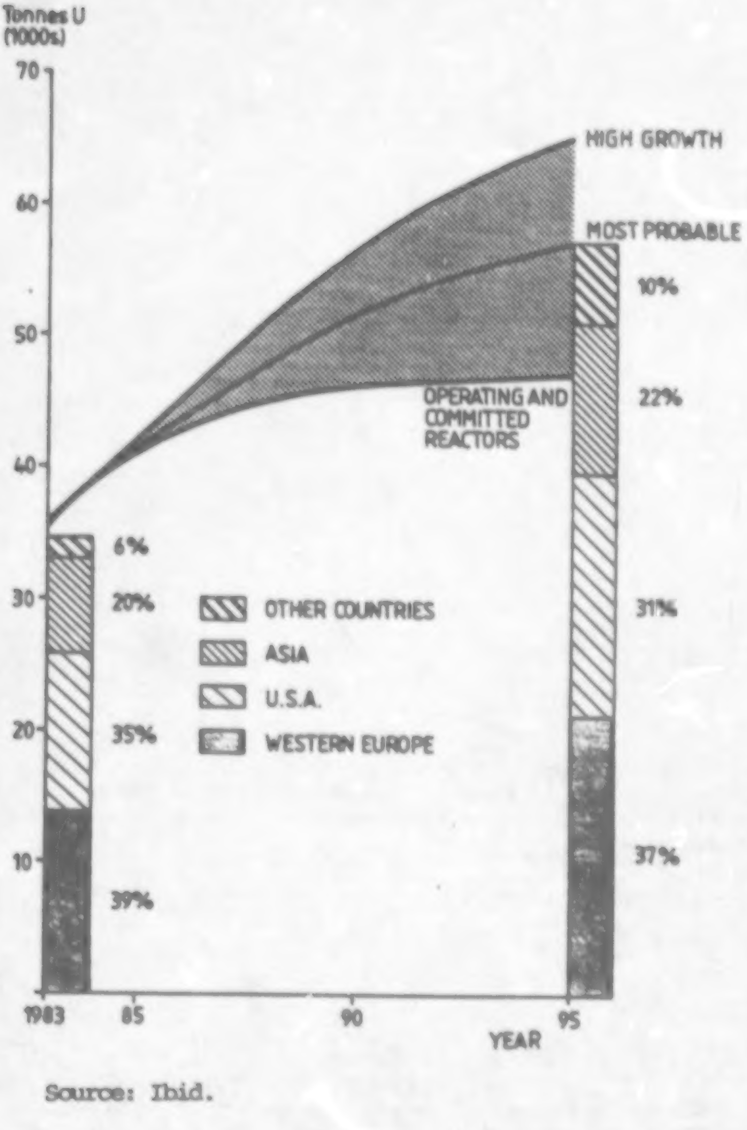
Source: Ibid, p. 37.

ANNUAL PRODUCTION AND REQUIREMENTS (WOCA) 1970-83



Source: William P. Geddes, Uranium Supply and Demand. Paper presented at the Ninth Annual Symposium of the Uranium Institute, London, September 5-7, 1984.

FUTURE URANIUM REQUIREMENTS



Source: Ibid.

(DOE 1984)

Projected U.S. Nuclear Power Capacity and Uranium Requirements

Year	Net Design Capacity[a] (GWe)	Uranium Requirements (Thousand Short Tons U_3O_8)		
		Reactor Requirements	Reported Utility Enrichment Feed Deliveries[b]	Apparent Utility Market Requirements
1983[c]	66.8	16.6	13.7	12.8
1984	72.1	17.3	17.2	14.6
1985	80.1	17.6	18.9	14.7
1986	97.2	17.7	19.7	17.5
1987	100.4	18.7	18.1	16.8
1988	110.5	20.0	22.1	17.0
1989	112.8	20.9	19.5	16.6
1990	114.0	21.7	19.9	21.0
1991	119.8	21.6	22.0	21.4
1992	122.1	21.7	20.3	20.1
1993	123.6	22.6	22.5	22.[illegible]
1994	122.7	23.2	23.2	23.2
1995	122.7	23.8	23.8	23.8
1996	124.6	24.3	24.3	24.3
1997	127.1	24.7	24.7	24.7
1998	129.4	26.0	26.0	26.0
1999	133.1	27.6	27.6	[illegible].6
2000	138.6	30.0	30.0	[illegible]0.0

[a] Capacity in operation at year-end (medium growth case).

[b] Includes all deliveries intended for utility usage.

[c] Actual.

Sources: Energy Information Administration, Commercial Nuclear Power: Prospects for the United States and the World, DOE/EIA-0438 (Washington, D.C., November 1983); Energy Information Administration, World Nuclear Fuel Cycle Requirements, DOE/EIA-0436(83) (Washington, D.C., February 1984); Energy Information Administration, 1982 Survey of United States Uranium Marketing Activity, DOE/EIA-0403 (Washington, D.C., September 1983).

Source: U. S. Department of Energy. United States uranium mining and milling industry. A comprehensive survey. May 1984. p. 8.

(DOE 1984)

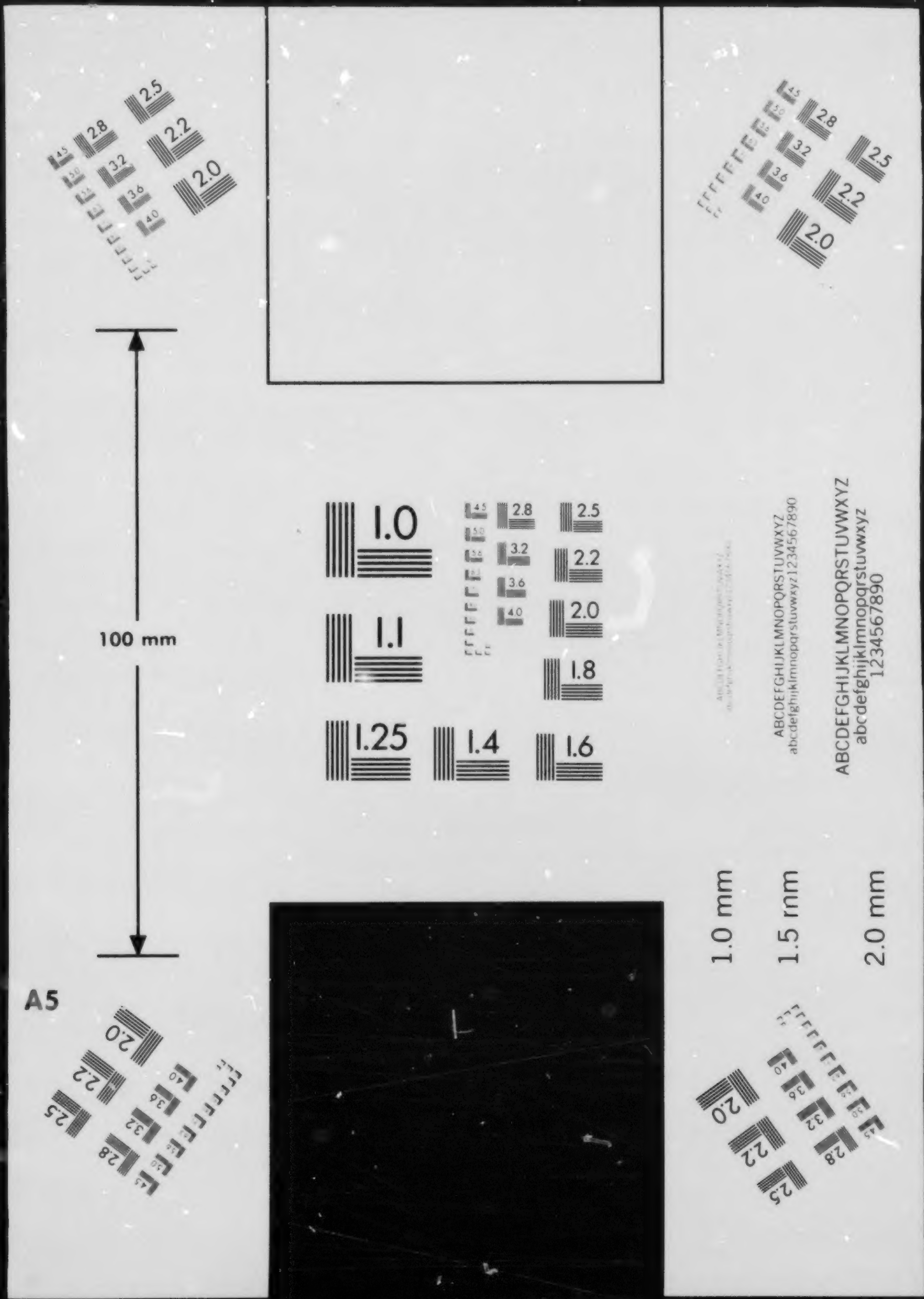
Foreign WOCA[a] Nuclear Power Capacity and Uranium Requirements

Year		Net Design Capacity (GWe)[b]	Uranium Requirements (Thousand Short Tons U_3O_8) Reactor Requirements	Apparent Market Requirements
1983[c]	.....	104.0	26.0	39.2
1984	......	117.5	27.6	38.8
1985	......	125.0	29.5	38.7
1986	......	141.6	31.8	37.2
1987	......	152.7	33.6	37.0
1988	......	163.7	35.7	36.8
1989	......	172.6	37.5	36.5
1990	......	180.0	38.9	36.0
1991	......	192.4	40.6	36.2
1992	......	202.2	42.7	37.8
1993	......	210.3	45.3	40.5
1994	......	216.8	47.6	43.5
1995	......	223.0	49.5	45.0
1996	......	233.4	51.6	48.2
1997	......	244.0	53.0	50.8
1998	......	255.4	55.4	53.2
1999	......	266.2	58.3	55.8
2000	......	276.0	60.9	58.8

[a] World outside centrally planned economic areas.
[b] In operation at year-end.
[c] Estimated.

Sources: Energy Information Administration, Commercial Nuclear Power: Prospects for the United States and the World, DOE/EIA-0438 (Washington, D.C., November 1983); Energy Information Administration, World Nuclear Fuel Cycle Requirements, DOE/EIA-0436(83) (Washington, D.C., February 1984); Nuclear Assurance Corporation, U_3O_8 Status Report (Norcross, Georgia, October 1983); Nuclear and Alternate Fuels Division, Office of Coal, Nuclear, Electric and Alternate Fuels, Energy Information Administration, U.S. Department of Energy (January 1984).

Source: Ibid., p. 13.


PG
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1.6
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2.0
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4.5
5.0
5.6
ABCDEFGHIJKLMNOPQRSTUVWXYZ
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ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
1234567890
1.0 mm
1.5 mm
2.0 mm

URANIUM ENRICHMENT

CONTENTS

Page
Introduction 387
Historical overview of leading enrichment technologies for production of low enriched uranium (NASAP, 1980) 388
Principles of leading enrichment technologies (NASAP, 1980) 389
Countries able to produce low and highly enriched uranium (CRS, 1984) 391
Projected world enrichment supply and demand, 1985, 1990 (SIPRI, 1984) 392
Proliferation sensitivity of various enrichment techniques (SIPRI, 1984) 393
Enrichment capacities and requirements in OECD countries to 2000 (OECD/NEA, 1985) 394
Projected worldwide demand and capacity for uranium enrichment to year 2025. (CBO, 1983) 395
Projected worldwide supply and demand balance for uranium enrichment, to year 2025. (CBO, 1983) 396
Total commitments and options for enrichment to year 2000, by foreign suppliers. (Lawrence Livermore Laboratory, 1983) 397
Foreign recipients of enrichment services to year 2000. (Lawrence Livermore Laboratory, 1983) 398

URANIUM ENRICHMENT

INTRODUCTION

The fissionable materials needed to make nuclear explosives are uranium-233, uranium-235, or plutonium. Uranium-235 makes up 0.7 percent of natural uranium. U-235 concentration can be increased by an isotope separation process called enrichment. Uranium enriched to a few percent U-235 is used to fuel light water nuclear power reactors, and some research reactors. It cannot be used directly to make nuclear explosives, although it can be used as feed material for producing highly enriched uranium. Uranium enriched to more than 90 percent U-235 is used to fuel some research reactors, high temperature gas-cooled power reactors, and naval propulsion reactors. It can also be used directly in nuclear explosives. Enrichment facilities in non-nuclear-weapons states that can produce highly enriched uranium can therefore contribute to the manufacture of nuclear weapons.

Gaseous diffusion and centrifugation are the two principal enrichment processes in use today. Of these two methods, gaseous diffusion is more difficult to conceal because it requires a large industrial installation and a large supply of electricity. This process is used by the United States, the Soviet Union, and the European company Eurodif. Centrifuge enrichment is used by URENCO, another European organization, and is being further developed in the United States, Japan, Brazil, and Pakistan. Development is ongoing for other enrichment processes, including laser isotope separation and aerodynamic and chemical processes. Clandestine use of laser enrichment technology would be particularly hard to detect because of the small size of the facilities required.

The work necessary to enrich uranium is expressed in "separative work units" [SWU's]. Typically, enrichment of enough fuel for a 1,000 Mwe nuclear powerplant requires from 125,000 to 284,000 SWU's per year, depending upon how efficiently the uranium is processed. The same amount of enriched uranium can be produced by either lightly processing a large amount of uranium, which is economical when uranium is cheap and SWU's are expensive, or by heavily processing less material, which is justifiable when uranium is expensive and SWU's are cheap. The amount of processing thus depends upon the relative prices of separative work and of uranium.

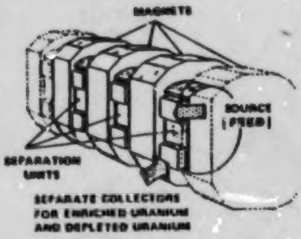
HISTORICAL OVERVIEW OF LEADING ENRICHMENT TECHNOLOGIES FOR PRODUCTION OF LOW ENRICHED URANIUM

(NASAP, 1980)

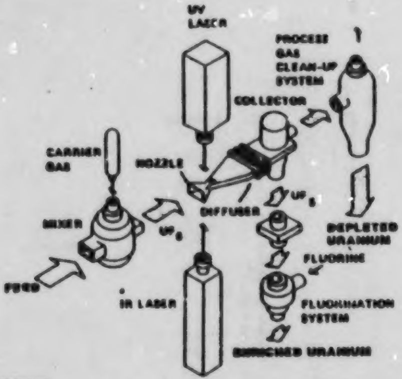
Technology	Period	Physical principle
Gaseous diffusion	Late 1940's on	Differential U-235/U-238 rates rates of collision with permeable walls.
Centrifuge	1950's R. & D., 1980's implementation	Enhancement of centrifugal effect by countercurrent flow.
Aerodynamic	1960's on	Centrifugal effects on UF in very small curved-wall chamber.
Calutron	1940's	Mass-dependent deflection of ions by strong magnetic field.
Chemical exchange	Concept dates from World War II. Serious R. & D. in 1970's.	Exploit isotope-dependent differential equilibria in a system of organic and aqueous uranium compounds.
Atomic vapor laser isotope separation (AVLIS).	1972 on	Multistep ionization of uranium metal vapor by optical laser.
Molecular vapor laser isotope separation (MLIS).	do	Laser chemistry on UF (supercooled through large expansion nozzle).
Plasma separation process (PSP).	1975 on	RF reinforcement of orbits or uranium vapor ions in strong magnetic field.

Source: Department of Energy, Nuclear Proliferation and Civilian Nuclear Power. Final report of the nonproliferation alternative systems assessment program. (NASAP) vol. II. Proliferation Resistance. June 1980, pp. 3-4. (NASAP report.)

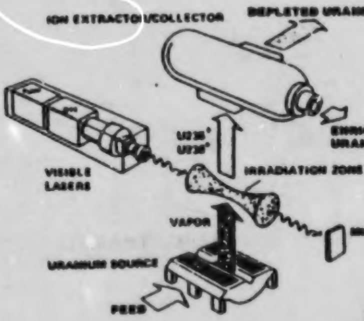
NASAP: PRINCIPLES OF LEADING ENRICHMENT TECHNOLOGIES


MAGNETS
SOURCE (FEED)
SEPARATION UNITS
SEPARATE COLLECTORS FOR ENRICHED URANIUM AND DEPLETED URANIUM

- CALUTRON

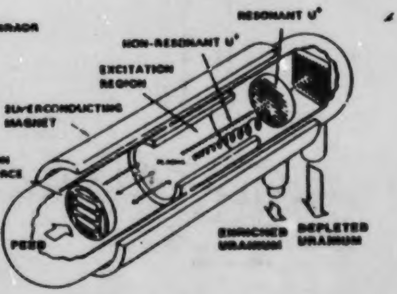

UV LASER
PROCESS GAS CLEAN-UP SYSTEM
COLLECTOR
CARRIER GAS
NOZZLE
UF_6
DIFFUSER
MIXER
UF_6
DEPLETED URANIUM
FLUORINE
FEED
IR LASER
FLUORINATION SYSTEM
ENRICHED URANIUM

- MOLECULAR LASER ISOTOPE SEPARATION PROCESS

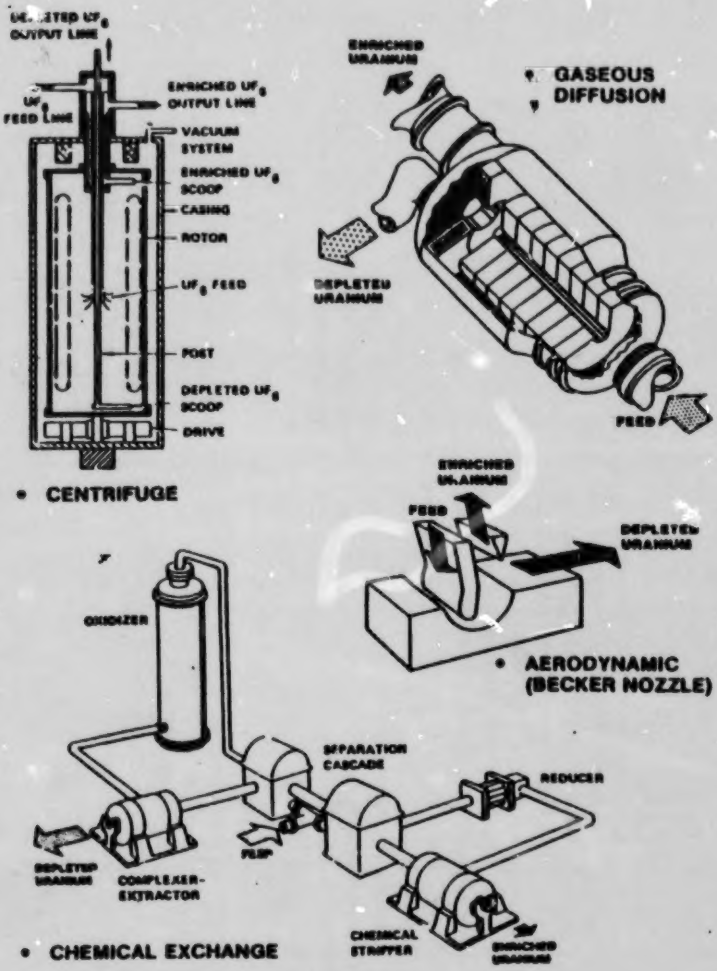

ION EXTRACTOR/COLLECTOR
DEPLETED URANIUM
ENRICHED URANIUM
$U235^+$
$U238^+$
VISIBLE LASERS
IRRADIATION ZONE
VAPOR
MIRROR
URANIUM SOURCE
FEED

- ATOMIC VAPOR LASER ISOTOPE SEPARATION PROCESS

- PLASMA ISOTOPE SEPARATION PROCESS


RESONANT U^+
NON-RESONANT U^+
EXCITATION REGION
SUPERCONDUCTING MAGNET
PLASMA
U ION SOURCE
FEED
ENRICHED URANIUM
DEPLETED URANIUM

Source: Ibid., vol. II. Proliferation resistance, p. 3–5.


DEPLETED UF$_6$ OUTPUT LINE
UF$_6$ FEED LINE
ENRICHED UF$_6$ OUTPUT LINE
VACUUM SYSTEM
ENRICHED UF$_6$ SCOOP
CASING
ROTOR
UF$_6$ FEED
POST
DEPLETED UF$_6$ SCOOP
DRIVE
• CENTRIFUGE
ENRICHED URANIUM
• GASEOUS DIFFUSION
DEPLETED URANIUM
FEED
ENRICHED URANIUM
FEED
DEPLETED URANIUM
• AERODYNAMIC (BECKER NOZZLE)
OXIDIZER
SEPARATION CASCADE
REDUCER
DEPLETED URANIUM
COMPLEXER-EXTRACTOR
FEED
CHEMICAL STRIPPER
ENRICHED URANIUM
• CHEMICAL EXCHANGE

Source: Ibid, pp. 3-5.

COUNTRIES ABLE TO PRODUCE LOW AND HIGHLY ENRICHED URANIUM
(CRS, 1984)

Country	Highly enriched uranium			Low enriched uranium		
	Laboratory scale	Pilot scale	Industrial scale	Laboratory scale	Pilot scale	Industrial scale
Argentina	x	x		x	x	
Australia	?			x		
Brazil	?			x		
China			x			x
Federal Republic of Germany				x		x*
France			x			x
Holland						x
Japan				x		x*
South Africa	x	x			x	
The United Kingdom		x				x
The United States		x				x
The Soviet Union		x				x

*/ To be constructed

Source: Congressional Research Service, 1984.

PROJECTED WORLD ENRICHMENT SUPPLY AND DEMAND, 1985, 1990
(SIPRI, 1984)

	1985			1990		
Countries	Enrichment capacity (t SWU/yr)	Enrichment needs for power reactors (t SWU/yr)[a]	Attainable uranium production (t/yr)[b]	Enrichment capacity (t SWU/yr)	Enrichment needs for power reactors (t SWU/yr)[a]	Attainable uranium production (t/yr)[b]
USA	27 300	12 500	34 100	29 500	15 200	44 200
USSR	7 000–10 000	>930[f]	7 000[g]	7 000–10 000	>930[f]	7 000[g]
Eurodif countries	10 800			10 800		
France	300–600[c] 50–100[d] (5 430)[e]	4 700	4 020	300–600[c] 50–100[d] (5 430)[e]	5 450	4 020
Italy	(1 890)[e]	600	120	(1 890)[e]	360	120
Belgium	(1 200)[e]	600		(1 200)[e]	600	
Spain	(1 200)[e]	860	1 272	(1 200)[e]	1 400	1 272
Iran	(1 080)[e]			(1 080)[e]		
Urenco countries	1 600[h]			2 000[h]		
UK	(400–700)	600		(700)	850	
Netherlands	(500–1 000)	55		(900–1 300)	55	
FR Germany	(0–400)	2 100	200	(0–400)	2 250	200
China	180	?	?	180	?	?
Japan	70–250	3 100	30	250–2 000	2 650	30
South Africa	200–300	200	10 600	200–300	200	10 400
Brazil	200–300	65	970	200–300	325	970
Argentina			680			680
Pakistan	?			?		
India	?	50	200	?	50	200
Australia	?		12 000	?		20 000
Canada		30	14 400		30	15 500
Sweden		1 300	400		1 100	400
South Korea		500			800	
Taiwan		700			550	
Switzerland		320			425	
Niger			10 500			12 000
Namibia			5 000			5 000
Gabon			1 500			1 500
Algeria			1 000[i]			1 000[i]
Central African Republic			1 000			1 000

[a] See appendix 8B; the figures here are rounded off.

[b] See reference [41].

[c] Gaseous diffusion plant at Pierrelatte.

[d] Chemical-exchange pilot plant.

[e] The total capacity of Eurodif is divided among the participating countries in proportion to their share in Eurodif, assuming that the division of shares will not change.

[f] Very little public information is available on Soviet plans for nuclear power growth. The minimum given here refers to the power plants which are scheduled to start operation in the early 1980s.

[g] No data are available about future plans. The given 7 000 t/yr refers to production in the late 1970s [45a].

[h] As of January 1981 the division of plants among the three participating countries was not yet completely agreed upon. However, it was known that the capacity in Almelo will include in part a joint West German–Dutch plant.

[i] See reference [123].

Source: Krass, et al. Uranium Enrichment and Nuclear Weapon Proliferation. SIPRI, 1984 , p. 237.

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PROLIFERATION SENSITIVITY OF VARIOUS ENRICHMENT TECHNIQUES

(SIPRI 1984)

	Separation factor	Equilibrium time and inventory	Size of dedicated facility	Ease of batch recycle	Reflux chemistry and criticality problems
Gaseous diffusion	3	3	3	3	1
Centrifuge	2	1	1	1	1
Aerodynamic					
Nozzle	3	1	2	2	1
Helikon	3	1	2	1	1
Chemical					
Solvent extraction	3	3	3	3	2
Ion exchange	3	3	3	3	2
Laser					
Molecular (MLIS)	1	1	2	1	1
Atomic (AVLIS)	1	1	2	3	3
Electromagnetic					
Calutron	1	1	3	2	3
Ion cyclotron resonance	1	1	2	2	3

Rating 1 implies that the factor presents a low barrier to misuse of the technique; rating 3 a significant obstacle to misuse; and rating 2 somewhere in between.

Source: Ibid, p. 19

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ENRICHMENT CAPACITIES AND REQUIREMENTS IN OECD COUNTRIES TO 2000

A) Enrichment Capacities

(d: diffusion, c: centrifuge) (Tonnes SWU/yr)

	1983	1984	1985	1990	1995	2000
France (d)	10 800	10 800	10 800	10 800	10 800	10 800
Germany, F.R. (c) Netherlands (c) (1) United Kingdom (c)	1 150	1 250	1 650	3 000	4 500	6 000
Japan (c)	50	50	50	250	1 000	2 800
United States (d)	27 200	27 300	27 300	27 300	27 300	27 300
United States (c)	0	0	0	1 900	11 700	13 200
OECD Total	40 200	39 400	39 800	43 250	55 300	60 100

B) Annual Enrichment Requirements

(Tonnes SWU)

	1983	1984	1985	1990	1995	2000
Belgium	450	450	650	650	650	650
Finland	260	260	260	260	370	370
France	3 500(2)	4 500(2)	5 300	6 600	8 000	9 300
Germany, F.R.	1 400	1 650	1 700	2 600	2 600	2 700
Italy	115	115	115	316	970	1 655
Japan	2 700	4 400	3 100	6 200	7 700	9 500
Netherlands	70	70	70	50	150	240
Spain	183	1 057	618	830	920(3)	1 050(3)
Sweden	800	800	900	1 000	1 000	1 000
Switzerland	260	370	370	370	370	450
Turkey	0	0	0	240	91	91
United Kingdom (4)	590	660	670(2)	730	1 190(2)	1 640
United States	7 200	8 300	7 900	10 300	11 200	13 000
OECD Total	17 500	22 600	21 700	30 200	35 200	41 600

1. Total for URENCO.

2. Secretariat's estimate.

3. Data from 1984 Brown Book.

4. Non-governmental forecasts.

Source: Summary of Nuclear Power and Fuel Cycle Data, OECD/NEA, 1985, p. 15.

PROJECTED WORLDWIDE DEMAND AND CAPACITY FOR FOR URANIUM ENRICHMENT, TO YEAR 2025

(CBO 1983)

(In millions of separative work units per year)

Year	Demand		U.S. Capacity	Foreign Capacity	Potential Excess Capacity Worldwide
	Lower	Higher			
1983	19.4	19.4	27.3	14.8	22.7
1985	22.7	25.3	27.5	15.1	17.3 to 19.9
1990	31.6	36.5	30.4	16.8	10.7 to 15.6
1995	38.7	46.6	31.2	25.5	10.1 to 18.0
2000	46.5	60.8	31.2	25.5	-4.1 to 10.2
2025	45.5	59.0	31.2	25.5	-2.3 to 11.2

Source: U.S. Congress. Congressional Budget Office. Uranium Enrichment: Investment Options for the Long Term. 1983, p. 21.

PROJECTED WORLDWIDE SUPPLY AND DEMAND BALANCE FOR URANIUM ENRICHMENT, TO YEAR 2025

(CBO, 1983)

(In millions of separative work units per year)

Year	Potential U.S. SWU Production		Foreign Production at 85 Percent of Capacity	Mid-Level World Demand	Potential Excess Production	Cumulative World SWU Inventory
	Base Case	Low Case				
1983	9.8	9.8	12.6	19.4	3.0	56.0
1985	16.7	12.1	12.8	24.0	0.9 to 5.5	58.9 to 65.8
1990	19.8	17.0	14.3	34.1	-2.8 to 0	52.4 to 76.8
1995	24.4	17.1	21.7	42.7	-3.9 to 3.4	35.1 to 87.0
2000	28.5	16.5	21.7	53.7	-15.5 to -3.5	-19.2 to 83.3
2010	28.5	18.0	21.7	52.3	-12.6 to -2.1	-158.3 to 56.0
2025	28.5	18.0	21.7	52.3	-12.6 to -2.1	-347.3 to 24.5

Source: Ibid, p. 22.

TOTAL COMMITMENTS AND OPTIONS FOR ENRICHMENT TO YEAR 2000, BY FOREIGN SUPPLIERS

LAWRENCE LIVERMORE LABORATORY, 1984

Supplier		Prior to 1984	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996-2000
		Delivery Dates													
TECHSNAB	COMMITTED	26615	2733	2637	2387	2410	2786	2755	2788	1021	1058	1016	984	796	2539
	OPTIONAL									129	129	129	129	129	645
EURODIF	COMMITTED	24884	6675	8054	7867	7985	7985	7985	6985						
	OPTIONAL								1000	10010	10010	10010	10010	10010	50050
URENCO	COMMITTED	2286	884	1628	1254	2258	2141	2141	2155	1996	1778	1772	1282	1112	610
BNFL	COMMITTED	3345	181	181	181	181	181	181	181	181	181	181	181	181	905
COGEMA	COMMITTED	864													
TOTAL COMMITTED		57994	10473	12500	11689	12834	13093	13062	12120	3198	3017	2969	2447	2089	4054
TOTAL OPTIONAL									1000	10139	10139	10139	10139	10139	50695
TOTAL ALL		57994	10473	12500	11689	12834	13093	13062	13120	13337	13156	13108	12586	12228	54749

DOE Deliveries are in Fiscal Years

Source: Lawrence Livermore Laboratory, Special Projects Division Status of foreign uranium enrichment activities. January, 1983 (unclassified) Prepared as part of the STAMAS Project for the U.S. Department of Energy, p. 1.

FOREIGN RECIPIENTS OF ENRICHMENT SERVICES TO YEAR 2000

(LLL, 1984)

Recipient	Supplier		Prior to 1984	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996-2000
AUSTRIA																
	TECHSNAB	COMMITTED	165													
	DOE	COMMITTED	398													
BELGIUM																
	TECHSNAB	COMMITTED	638	58	58	80	80	80	80	80	80	80	80	80	80	
	EURODIF	COMMITTED	1981	410	560	560	1150	1150	1150	1150						
		OPTIONAL									1070	1070	1078	1078	1070	5350
	COGEMA	COMMITTED	425													
	DOE	COMMITTED	2373													
BRAZIL																
	URENCO	COMMITTED	570	170	170	170	340	340	340	340	170	170	170	170		
	DOE	COMMITTED	178													
EGYPT																
	DOE	COMMITTED										360	360	120	240	1440
		OPTIONAL														114
FINLAND																
	TECHSNAB	COMMITTED	2221	294	261	294	261	294	261	294	261	298	256	289	256	1379
FRANCE																
	TECHSNAB	COMMITTED	10009	750	750	750	750	750	750	750						
	EURODIF	COMMITTED	15945	4800	5700	5700	5310	5310	5310	5310						
		OPTIONAL									5310	5310	5310	5310	5310	26550
	COGEMA	COMMITTED	43													
	DOE	COMMITTED	5026	220	296	262										
GERMANY,W.																
	TECHSNAB	COMMITTED	6529	658	642	618	503	503	503	503	519	519	519	519	364	600
		OPTIONAL									129	129	129	129	129	645

FOREIGN RECIPIENTS OF ENRICHMENT SERVICES TO 2000

Recipient	Supplier		Prior to 1984	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996-2000
									Delivery Dates							
GERMANY,W.																
	EURODIF	COMMITTED	415	135	125											
	URENCO	COMMITTED	533	183	822	332	1165	979	979	1139	1139	996	990	990	990	470
	DOE	COMMITTED	8969	399	360	654	583	650	677	657	637	303	326	396	224	
		OPTIONAL														1419
INDIA																
	DOE	COMMITTED	672													
ITALY																
	TECHSNAB	COMMITTED	3451	273	281											
	EURODIF	COMMITTED	1354	250	582	525	525	525	525	525						
		OPTIONAL									1560	1560	1560	1560	1560	7800
	DOE	COMMITTED	1524													
JAPAN																
	EURODIF	COMMITTED	4000	1000	1000	1000	1000	1000	1000							
		OPTIONAL								1000	1000	1000	1000	1000	1000	5000
	DOE	COMMITTED	25599	1988	3398	2548	2680	3396	3002	3879	3113	2321	2074	2025	1453	3670
		OPTIONAL							671	1078	2301	2436	2265	2142	1309	13046
KOREA																
	DOE	COMMITTED	996	317		319	530	512	526	110						
		OPTIONAL							27	270	630	630	630	630	630	3150
MEXICO																
	DOE	COMMITTED	338			102										
		OPTIONAL								76	76	76	76	76	152	760
NETHERLANDS																
	EURODIF	COMMITTED	25	5	5											
	URENCO	COMMITTED	67	6	11		1	70	70	70	70	70	70	70	70	140
	DOE	COMMITTED	1041	70	70	70	70	5		60	61		86			

FOREIGN RECIPIENTS OF ENRICHMENT SERVICES TO 2000

Recipient	Supplier		Prior to 1984	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996-2000
			Delivery Dates													
PHILIPPINES																
	DOE	COMMITTED	174		79	69	69	69	69							
		OPTIONAL										85	85	85	85	425
S.AFRICA																
	DOE	COMMITTED	525													
SPAIN																
	TECHSNAB	COMMITTED	1297	580	580	580	670	1000	1000	1000						
	EURODIF	COMMITTED	916													
		OPTIONAL									1070	1070	1070	1070	1070	5350
	DOE	COMMITTED	3896	454	556	532	533	439	85							
SWEDEN																
	TECHSNAB	COMMITTED	900	55			81	94	96	96	96	96	96	96	96	480
	DOE	COMMITTED	6545	496	639	582	656	709	620	358	358	249	358	419	310	444
		OPTIONAL							95	95	413	523	523	523	523	2615
SWITZERLAND																
	EURODIF	COMMITTED	164	75	82	82										
	URENCO	COMMITTED				52	52	52	52	52	52	52	52	52	52	
	COGEMA	COMMITTED	396													
	DOE	COMMITTED	3926	378	301	158	224	400	100	100	174	45	45	45	45	
		OPTIONAL				45	45	45	45	45	45	45	200	176	169	840
TAIWAN																
	DOE	COMMITTED	3131	402	410	198	713	527	416		210	216	210		216	852
		OPTIONAL								220	220	220	220	412	412	2444
THAILAND																
	DOE	COMMITTED			45	47	73									
UN.KINGDOM																
	TECHSNAB	COMMITTED	350	65	65	65	65	65	65	65	65	65	65			

FOREIGN RECIPIENTS OF ENRICHMENT SERVICES TO 2000

Recipient	Supplier		Prior to 1984	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996-2000
			Delivery Dates													
UN,KINGDOM																
	URENCO	COMMITTED	1116	525	625	700	700	700	700	565	565	490	490			
	BNFL	COMMITTED	3345	181	181	181	181	181	181	181	181	181	181	181	181	905
YUGOSLAVIA																
	EURODIF	COMMITTED	84													
	DOE	COMMITTED	350	174	69	78	69	69								

DOE Deliveries are in Fiscal Years

Source: Ibid, p. 8-11.

FUEL REPROCESSING AND SPENT FUEL MANAGEMENT

CONTENTS

Page

Introduction 405

Reprocessing schematic (SIPRI, 1979) 406

Comparison of isotopic composition of plutonium produced in Candu and PWR reactors (Harrison, 1982) 407

Fuel reprocessing and waste management in nuclear power programs outside the United States (Atomic Industrial Forum, 1985) 408

Free World (outside U.S.) commercial plutonium generation and prior rights consent status (Kratzer, 1983) 410

Commercial reprocessing plants (Patterson, 1985) 411

Plutonium produced in world nuclear powerplants (Albright, 1983) 414

Plutonium discharge rate and isotopic composition, by type of power reactor (Albright, 1985) 415

Plutonium discharged in spent fuel from power reactors in the Western world, cumulative total (Albright, 1985) 418

Plutonium discharged in light water reactor spent fuel in the Western world, cumulative total (Albright, 1985) 419

Plutonium discharged in western non-light water reactor spent fuel, cumulative total (Albright, 1985) 421

Plutonium discharged in spent fuel from major power reactors in Communist countries, cumulative totals (Albright, 1985) 423

Reprocessing capacities of major civilian reprocessors of power reactor fuel (Albright, 1985) 425

Reprocessing capacities of major civilian reprocessors to 2000 (Albright, 1985) .. 427

Plutonium separated from light water reactor spent fuel at La Hague, France, through 1983 (Albright, 1985) 434

Amount of spent fuel and plutonium from commercial light water reactors contracted for reprocessing in France and Britain (Albright, 1985) 435

Amount of plutonium separated from civilian power reactor spent fuel by major reprocessors (Albright, 1985) 437

Source and amount of separated plutonium in various countries through the year 2000 (Albright, 1985) 443

Spent fuel storage capacities and arisings in OECD countries to 2000 (OECD/NEA, 1985) 445

Reprocessing capacities in OECD countries (OECD/NEA, 1985) 446

Reprocessing capacities of the Western world (Braun, 1984) 447

Spent fuel and reprocessing capacities of Western Europe (Braun, 1984) 448

Current national reprocessing commitments (Braun, 1984) 449

Experience with plutonium recycle (Bairiot, 1984) 450

FUEL REPROCESSING AND SPENT FUEL MANAGEMENT

INTRODUCTION

Nuclear fuels are only partially consumed in a nuclear reactor. The used, or "spent" fuel from a light-water type power reactor typically contains U-235 (at a higher concentration than is found in natural uranium), some plutonium, and residual U-238. The U-235, U-238 and plutonium in spent fuel can be recovered for future use in new nuclear fuel by chopping up the spent fuel, dissolving it in strong acid, and separating the desired materials from the highly radioactive wastes. This is called reprocessing.

The spent fuel from a typical light water power reactor contains about one percent plutonium. At this concentration, about 10 kg of plutonium can be separated from one metric ton of spent fuel, assuming no losses. Since a typical PWR type nuclear powerplant of 1,000 megawatts generating capacity discharges about 30 metric tons of spent fuel annually, reprocessing it would provide some 300 kg of plutonium per year. Although the quality of plutonium from power reactors is poor for the manufacture of nuclear weapons, it could be used to make crude nuclear explosive devices.

Typical reasons given for reprocessing are that it:

(1) Can greatly increase the amount of energy ultimately recovered from each kilogram of uranium mined, and reduce the enrichment requirements for conventional power reactors by supplying recycled plutonium for use as a supplement in nuclear fuel;

(2) Is necessary for the effective management of high level radioactive wastes from nuclear power plants; and

(3) Can help to reduce the energy dependency of countries that do not have uranium resources.

Typical arguments given against reprocessing are that it:

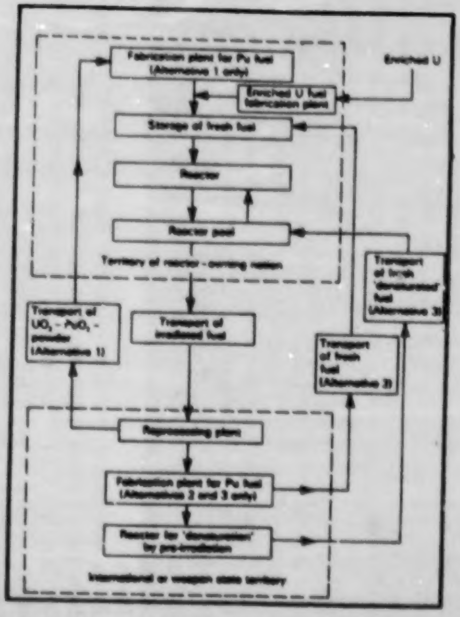
(1) Would cause accumulations of separated plutonium, thereby increasing the chances that it might be stolen to make a nuclear explosive;

(2) Is not necessary for management and ultimate disposal of high level radioactive wastes from nuclear power plants; and

(3) Would cost so much that recovered plutonium could not compete economically with enriched uranium as a nuclear fuel, particularly at a time when there is an oversupply of uranium and enrichment.

402

SIPRI: Reprocessing Schematic


Fabrication plant for Pu fuel (Alternative 1 only)
Enriched U
Enriched U fuel fabrication plant
Storage of fresh fuel
Reactor
Reactor pool
Territory of reactor-owning nation
Transport of UO₂ - PuO₂ - powder (Alternative 1)
Transport of irradiated fuel
Transport of fresh 'denaturated' fuel (Alternative 3)
Transport of fresh fuel (Alternative 2)
Reprocessing plant
Fabrication plant for Pu fuel (Alternatives 2 and 3 only)
Reactor for 'denaturation' by pre-irradiation
International or weapon state territory

Source: Stockholm International Peace Research Institute. Nuclear energy and nuclear weapons proliferation. London: Taylor and Francis Ltd., 1979, p. 96. (SIPRI)

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COMPARISON OF ISOTOPIC COMPOSITION OF PLUTONIUM PRODUCED IN CANDU AND LWR REACTORS

Plutonium isotope	CANDU a/ gm/kg	LWR b/ gm/kg
Pu-239	2.4	5.9
Pu-240	1.0	2.7
Pu-241	0.2	1.3
Pu-242	0.1	0.5
Total	3.8	10.4
Total fissile material (Pu-239 +Pu-241 & 242)	2.7	7.2
Ratio of fissile to non-fissile isotopes	0.7	0.69

a/ Fuel burnup at 7,000 MWD/T
b/ Fuel burnup at 31,000 MWD/T

Note: Units are grams of Plutonium per kilogram of heavy metal in spent fuel at time of removal from the core.

Source: Correspondence from Dr. John Harrison, Canadian Embassy, February 5, 1982

FUEL REPROCESSING AND WASTE MANAGEMENT IN NUCLEAR POWER PROGRAMS OUTSIDE THE U.S.

The United Kingdom. British Nuclear Fuels, Ltd., has reprocessed fuel at its Sellafield plant (formerly Windscale) in Cumbria since 1952. The design capacity of the present plant, which became operational in 1964, is five tonnes of uranium per day. The U.K. program is mainly concerned with domestic materials, but some fuel from overseas is treated.

Plutonium from reprocessing foreign fuel is normally returned to the country of origin, subject to adequate safeguards. Plutonium from U.K. sources is used to fuel the Dounreay prototype fast-breeder reactor or is stored for future use in breeders.

Low-activity liquid waste is discharged, in accordance with regulations, into the Irish Sea. Some low-activity solid waste is buried. Other wastes are stored, prior to treatment and eventual disposal.

France. In addition to the Marcoule plant, devoted to reprocessing metallic fuel since 1958, the Cogema La Hague plant near Cherbourg has been operating since 1967. Present capacity is 400-metric-tons-per-year of oxide fuel with 1,200 more scheduled to come on line in 1987. Domestic and foreign spent fuels are handled in the French program. High-level wastes are currently vitrified at the AVM, Marcoule, an industrial pilot plant using a continuous process.

Domestic plutonium is used in the French program. Reprocessed uranium, plutonium and vitrified high-level wastes from foreign spent fuel are to be returned to the countries of origin.

The Federal Republic of Germany. It has had the WAK plant of Wiederaufarbeitungsaulage Karlsruhe in operation since 1971, with 35-metric-tons-per-year capacity. All plutonium not needed for the breeder is being recycled to commercial light-water reactors.

In an experimental program, small quantities of plutonium are being recycled to a commercial light-water reactor and the KNK II fast-breeder reactor. Most of the plutonium is to be used later in other fast-breeder reactors. High-level wastes are stored for later solidification and permanent storage in salt deposits.

The West German program also includes a middle-size demonstration reprocessing plant to be built and operated by the Deutsche Gesellschaft für Wiederaufarbeitung von Kernbrennstoffen mbH (DWK) and scheduled to begin operation in the 1990s.

Japan. The Power Reactor and Nuclear Fuel Development Corporation reprocessing plant in Tokai, with 0.7-metric-tons-per-day capacity, handles part of the spent fuel from domestic nuclear power plants.

Plutonium is scheduled for use in breeder and other reactor research and development. High-level waste will be vitrified and disposed after storage.

India. The Department of Atomic Energy Power Reactor Fuel Reprocessing plant in Tarapur, with 100-metric-tons-per-year capacity, handles spent fuel from the Rajasthan nuclear power station. Seperated plutonium is converted to oxide and the high- and medium-level liquid wastes are kept in interim storage for now.

Canada. A major research and development effort begun in 1978 is underway to dispose of either immobilized fuel or reprocessing waste deep in a hard rock formation of the Canadian Shield. Research and development is also in progress on a laboratory scale on apsects of the reprocessing option in support of the thorium fuel cycle in CANDU reactors.

Those countries shipping spent fuel from their nuclear power plants abroad for reprocessing are Belgium, Switzerland and Italy. West Germany ships some of its spent fuel to France and Japan ships some of its spent fuel to France and the United Kingdom.

There are other countries with no reprocessing/waste-management plants at present: Brazil, Taiwan, South Korea, Mexico, the Philippines, South Africa.

Details of waste-management programs for Eastern Bloc countries are not reported in the AIF survey, although international industry observers assume they are concentrated in the Union of Soviet Socialist Republics. The Soviet program envisions chemical reprocessing, recycle of plutonium into fast breeders and geologic storage of waste.

Sweden. Sweden has decided not to reprocess any more fuel but to place it in a temporary storage facility for 40 years. After that, the spent fuel will be placed in a final repository.

December 31, 1984

Source: Atomic Industrial Forum, International Survey.

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(Kratzer, 1983)

FREE WORLD (OUTSIDE U.S.) COMMERCIAL PLUTONIUM GENERATION AND PRIOR CONSENT STATUS[a]

CUMULATIVE (kg of Fissile Plutonium) TO YEAR 2000

	Total Fissile Plutonium	U.S. Prior Consent	Other Case-by-Case	No Case-by-Case	Known Reprocessing Commitments MTU (kg Pu)[f]
I. Euratom[b]					
France	160,000	6,800	–	153,200	34,400 (160,000)
United Kingdom	84,700	–	–	84,700	42,000 (84,700)
Federal Republic of Germany	61,900	28,500	–	33,400	2,700 (17,500)
Belgium	15,400	6,200	–	9,200	300 (2,900)
Netherlands	2,200	1,900	–	300	200 (1,300)
Italy	10,400	1,600	–	8,800	1,200 (8,450)
II. Other Major Nuclear Countries					
Canada	100,900	–	–	100,900	–
Japan	83,900	72,600	–	11,300	6,200 (40,300)
Spain	37,000	18,100	–	18,900	1,700 (11,000)
Sweden	29,100	26,700	–	2,400	600 (5,200)
Switzerland	11,700	7,500	–	4,200	900 (5,200)
III. Industrializing Countries					
South Korea	17,200	10,200	7,000[c,d]	–	
Taiwan	10,600	10,600	–	–	
Philippines	1,300	1,300	–	–	
Mexico	3,300	3,300	–	–	
IV. Countries Not Meeting NNPA Export Criteria					
Argentina	14,300	–	14,300[e]	–	
Brazil	8,800	200	8,600[e]	–	
India	12,000	600	–	11,400	
Pakistan	1,000	–	1,000[c]	–	
South Africa	4,300	–	4,300[d]	–	

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[a] Assumptions and methodology discussed in the Appendix.

[b] Under the present U.S.-Euratom Agreement for Cooperation, there is no U.S. right of prior consent. Values shown under the "U.S. Prior Consent" column for Euratom countries are for U.S. fueled reactors. These amounts would be subject to prior consent only if and when the U.S.-Euratom Agreement is amended to include this right.

[c] Canadian prior consent rights based on supply of CANDU reactors.

[d] French prior consent rights based on supply of French LWR's.

[e] German prior consent rights based on supply of German LWR's.

[f] Separated plutonium based on average of 6.5 kg of fissile plutonium per MTU of spent fuel, except for French and British fuel, some of which is gas-cooled reactor fuel with lower plutonium content.

Source: Myron B. Kratzer. Prior consent and nuclear cooperation. Atomic Industrial Forum, 1983, p. 4.

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Commercial Reprocessing Plants (Patterson, 1985)

Country	*Location*	*Name*	*Owner*	*Fuel input*	*Original design capacity*	*Start-up*	*Status 1984*	*Throughput (tonnes)*
United States	West Valley, New York	Nuclear Fuel Services	Nuclear Fuel Services	various – mostly low burnup	300 tonnes/ year	1966	permanent shutdown 1972	625 tonnes in all
United States	Morris, Illinois	Midwest Fuel Recovery Plant	General Electric (US)	(none)	—	did not start up	—	—
Britain	Windscale	B205	British Nuclear Fuels Ltd	metal	1500 tonnes/ year*	1964	operational	20 000 tonnes (including weapons material)
Britain	Windscale	B204	British Nuclear Fuels Ltd	oxide	300 tonnes/ year*	1969	permanent shutdown 1973	100 tonnes in all
Britain	Windscale	Thermal Oxide Reprocessing Plant	British Nuclear Fuels Ltd	oxide	1000 tonnes/ year*	construction not commenced early 1984	?	—

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Commercial Reprocessing Plants (Patterson, 1985), cont.

Country	*Location*	*Name*	*Owner*	*Fuel input*	*Original design capacity*	*Start-up*	*Status 1984*	*Throughput (tonnes)*
France	Marcoule	Usine Plutonium-1	Cogema	metal	250 tonnes/ year	1958	operational	not known (includes weapons material)
France	Cap la Hague	Usine Plutonium-2	Cogema	metal	800 tonnes/ year	1966	operational	not known (includes weapons material)
France	Cap la Hague	Haute Activité Oxide	Cogema	oxide	400 tonnes/ year*	1976	operational	510 tonnes to end June 1982
France	Cap la Hague	Usine Plutonium-3	Cogema	oxide	800 tonnes/ year*	under construction	?	—
Belgium	Mol	Eurochemic	Eurochemic	various – mostly low burnup	70–100 tonnes/year*	1966	shutdown 1974; possible restart	180 tonnes in all
Federal Germany	Karlsruhe	Wiederaufarbeitungsanlage Karlsruhe	Karlsruhe Nuclear Research Centre/DWK	various	40 tonnes/ year	1969	operational after shutdown	(experimental)

Commercial Reprocessing Plants (Patterson, 1985), cont.

Country	*Location*	*Name*	*Owner*	*Fuel input*	*Original design capacity*	*Start-up*	*Status 1984*	*Throughput (tonnes)*
Federal Germany	Dragahn	not known	DWK	oxide	350 tonnes/ year	in planning stage	—	—
Japan	Tokai Mura	Tokai Mura	Power Reactor and Nuclear Fuel Corp	oxide	210 tonnes/ year	1978	shutdown after leaks	less than 150
India	Trombay	Trombay	Department of Atomic Energy	oxide	50 tonnes/ year	1964–65	shutdown 1974	not known
India	Tarapur	Tarapur	Department of Atomic Energy	oxide	100 tonnes/ year	1978 (tests); 1981	operational	not known
Argentina	Ezeiza	Ezeiza	Comisión Nacional de Energía Atómica	oxide	25? tonnes/ year	1984?	under construction	—
Pakistan	Chashma	not known	Atomic Energy Commission	oxide	not known	not known	not known	—
Brazil	Resende	not known	Instituto de Pesquisas Energeticas de Nucleares	oxide	2–3 tonnes/ year	1990?	under construction	—

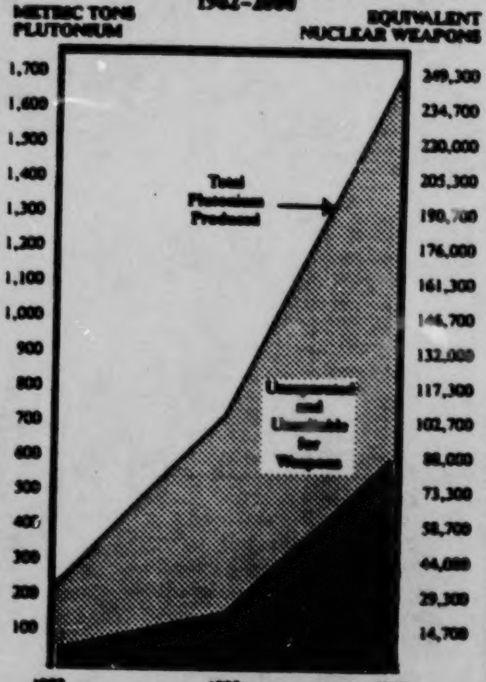
Source: Walter Patterson, The Plutonium Business, 1985, p. 40-43.

(Albright 1983)

PLUTONIUM PRODUCED IN WORLD NUCLEAR POWERPLANTS

(Non-Communist Countries)

1982–2000



WORLD POWERPLANT PLUTONIUM
(Metric Tons)

YEAR	1982	1990	2000
Unseparated	175	560	1150
Separated	44	150*	[illegible]*
TOTAL PLUTONIUM	219	710	1730

*Based on planned reprocessing capabilities worldwide.

Source: Albright, David. World Inventory of Civilian Plutonium and the Spread of Nuclear Weapons. A Special Report of the Nuclear Control Institute. May 1983.

Table 1
Plutonium Discharge Rate and Isotopic Composition, by Type of Power Reactor

Reactor	Plutonium Discharged[a] (kg. Pu/GWe(net)-year)	Typical Isotopic Composition of Plutonium in Spent Fuel[b] (per cent by weight)				
		Pu-238	Pu-239	Pu-240	Pu-241	Pu-242
LWR[c]	330	2.5	58.5	24	11	4
Candu[d]	650	-[e]	68	24.5	6	1.6
Magnox[f]	800	-[e]	76	20	4	-
LWGR[g]	300	0.7	48	35	10.3	6
LMFBR[h]						
core plus blanket	220	-	70	25	3	2
blanket only	365	-	97	3	-	-
core only	-145	-	58	34	5	3

Note: The main types of commercial nuclear power reactors are the light water reactor (LWR), the graphite moderated gas-cooled reactor (also called the magnox reactor), a heavy water moderated reactor called the candu reactor, and a light water graphite moderated reactor (LWGR) found in the Soviet Union. The liquid metal fast breeder reactor (LMFBR) is under comercial development.

Source: David Albright, World Inventories of Civilian Plutonium. Center for Energy and Environmental Studies, Princeton University, and Federation of American Scientists, Washington, D.C. Working Draft of paper prepared for the Conference on International Terrorism: The Nuclear Dimension, June 24-25, 1985, Washington, D.C., sponsored by the Nuclear Control Institute.

References and Comments For Table 1

a. The rate at which plutonium is discharged in spent fuel for each type of reactor is the typical amount of plutonium that is discharged in the spent fuel each year by a 1,000 MWe (net) plant operating for 365 days, i.e. one that has a 100% capacity factor, in a mode optimized for electricity production. (The net electricity production as distinguished from gross or total electricity production is the energy produced by the reactor, less the energy to produce and operate the reactor.) The actual discharge rate for a specific reactor depends on the reactor's capacity factor for that year, its thermal efficiency, the frequency of fuel reloading, the extent to which the fuel is reshuffled during refueling, and the fuel's enrichment.

b. The isotopic composition of the plutonium is at the time that the plutonium is discharged from the reactor. Because Pu-241 has a half life of only 13.2 years, after the end of one year the amount of Pu-241 will have decreased by about 5 percent.

c. U.S. Department of Energy, Nuclear Proliferation and Civilian Nuclear Power, Report of the Nonproliferation Alternative Systems Assessment Program, Volume IX: Reactor and Fuel Cycle Descriptions, pp. 13 and 14. The plutonium discharge rate for the pressurized water reactor (PWR) is 325 kg. plutonium per GWe (net) per year and for the boiling water reactor is 340 kg. plutonium per GWe (net) per year. Since roughly two thirds of the reactors are PWRs and one third are BWRs, the value listed in the table is an average for this specific combination of reactors. The PWR used as a standard in the DOE study uses fuel that is 3 percent enriched uranium and achieves an average burnup of 30,400 MWt-d/MTU. The BWR uses 2.9 percent enriched uranium and achieves an average burnup of about 28,000 MWt-d/MTU. The isotopic composition of the plutonium listed above is typical of these burnups.

d. Y.A. Chang and C. Till, "Alternative Fuel Cycle Options," ANL-77-70, Argonne National Laboratory, September 1977. (Also in a set of tables titled "Fuel Cycle Options and Fueling Modes," circa 1977.) The burnup of the spent fuel is 7,500 MWt-d/MTU and the plutonium production rate is normalized to a 100 percent capacity factor.

e. Negligible quantities.

f. A fairly typical discharge rate for British gas-cooled reactors is 800 kg. plutonium per GWe (net) per year (Official Report of the House of Commons, Hansard, 27 July 1983, column 439. This rate was supplied by the Secretary of State for Energy). Another estimate can be derived from data on a French gas-graphite reactor (Syndicat CFDT de l'Energie Atomique, Le Dossier Electronucleaire, (Editions du Seuil, 1980), p. 51). For a French reactor whose fuel is discharged at a burnup of 4,000 MWt-d/MTU, the spent fuel contains 2.5 kg. of plutonium per MTU with the isotopic composition listed in the table. Dividing these numbers gives the plutonium production rate in terms of thermal power - 228 grams of plutonium discharged per MWt-year. French gas-graphite reactors have an average thermal efficiency of about 0.28 based on net electricity production and about 0.30 based on gross electricity production ("General Information," Nuclear Engineering International, October Supplement, October 1984). Thus, the plutonium discharge rate in terms of electricity production is 815 kg. Pu/GWe (net)-year and 760 kg. Pu/GWe (gross)-year which agrees reasonably well with the British government estimate mentioned above if the corresponding spent fuel has a burnup of 4,000 MWt-d/MTU. The isotopic composition data in the table are for 4,000 MWt-d/MTU (Le Dossier, op. cit.).

In general, the burnup of the fuel in both French and British gas-graphite reactors is now about 4,000 to 5,000 MWt-d/MTU. In the past it was significantly lower and in the future it might be even higher.

g. The discharge rate for the LWGR is for both types, the RBMK-1000 and the RBMK-1500. The fuel is enriched to 1.8 % and discharged with a nominal burnup of about 18,000 MWt-d/MTU (I. Ya. Emel'yanov, A.D. Zhirnov, V.I. Pushkarev, and A.P. Sirotkin, "Increasing the Efficiency of Uranium Utilization In the RBMK-1000 Reactor," translated from Atomnaya Energiya, vol. 46, No. 3, pp. 139-141, March 1979, Plenum Publishing Corporation). The isotopic composition of the plutonium is interpolated from burnup data for 18,000 and 20,000 MWt-d/MTU (T.S. Zaritskaya, A.K. Kruglov, and A.P. Rudik, "The Formation of Transuranium Nuclides in Connection with the Combined Use of VVER and RBMK Power Reactors," translated from Atomnaya Energiya, vol. 46, No. 3, pp. 183-185, March 1979, Plenum Publishing Corporation).

h. J. Bussac and P. Reuss, Traite de Neutronique, Herman, 1978, pp. 583-588. The values from this book are normalized to a 1000 MWe plant and a 100 percent capacity factor. Unlike the other reactors in this table, which use uranium fuel that initially contains no plutonium, the breeder reactor's fuel contains about 15 to 25 percent plutonium. Thus, the discharge rates for the breeder reactor core refer only to the net increase or decrease in the plutonium. The amount of plutonium discharged in breeder spent fuel is considerably greater than the amount discharged in the spent fuel of the other reactors in this table. A 1000 MWe breeder reactor operating at a 70 percent capacity factor will discharge roughly 1,500 to 2,000 kilograms of plutonium each year depending on its design and mode of operation (DOE, Nuclear Proliferation, op. cit., p. B-30.)

Table 2
Plutonium Discharged in Spent Fuel from Power Reactors in the Western World
Cumulative Total (metric tons)[a]

Country[b]	Through 1984	Through 1990	Through 2000
Argentina	2.0	4.4	13
Bangladesh	-	-	?
Belgium	5.0	12	27
Brazil	0.1	1.4	8
Canada	28	67	140
Egypt	-	-	2
Finland	3.0	6.3	13
France	36	93	210
Germany, West	17	45	99
India	1.75	4.8	16
Italy	3.6	5.4	15
Japan	27.7	64	153
Korea	1.5	8.4	30
Libya	-	-	?
Mexico	-	0.8	3.5
Netherlands	1.5	2.1	4.3
Pakistan	0.3	0.5	2.4
Philippines	-	0.5	1.9
South Africa	0.1	1.9	6
Spain	6.0	14	28
Sweden	10	22	40
Switzerland	5.1	9.4	18
Syria	-	-	?
Taiwan	3.0	9.3	23
Turkey	-	-	?
United Kingdom	41.7	58	87
USA	100	200	400
Yugoslavia	0.4	1.0	3
TOTALS[c]	300	630	1350

References and Comments

a. The sources for this table are described in tables 3 and 4 and in the text.

b. Other countries, such as Iran and Iraq, might also have nuclear reactors in operation by the end of this century.

c. Totals rounded-off

Source: Ibid.

Table 3
Plutonium Discharged in Light Water Reactor Spent Fuel in the Western World
Cumulative Total (metric tons)[a]

Country	Through 1984	Through 1990	Through 2000
Bangladesh	--	--	?[b]
Belgium	5.0	14	27
Brazil	0.1	1.4	8
Egypt	--	--	2
Finland	3.0	6.3	13
France	21	71	180
Germany, West	17	45	99
India	1.0	1.4	2
Israel	--	--	1
Italy	1.4	2.7	12
Japan	26	62	150
Korea, South	1.0	6.3	25
Libya	--	--	?[c]
Mexico	--	0.8	3.5
Netherlands	1.5	2.1	4.3
Pakistan	--	--	1.4[d]
Philippines	--	0.5	1.9
South Africa	0.1	1.9	6
Spain	2.6	8.9	21[e]
Sweden	10	22	40
Switzerland	5.1	9.4	18
Syria	--	--	?[f]
Taiwan	3.0	9.3	23
United Kingdom	--	--	3[g]
USA	100	200	400
Yugoslavia	0.4	1.0	3
TOTALS[h]	200	460	1050

References and Comments

a. The cumulative totals ignore reductions in the amount due to the decay of plutonium-241, half of which decays every 13 years.

b. The Soviet Union has offered to finance Bangladesh's 440 MWe pressurized water reactor. Whether the government will accept is unknown. See Nuclear Engineering International, February 1985, p. 7.

c. Libya might receive twin 440 MWe pressurized water reactors from the Soviet Union. A Belgian company was to have participated in the construction of the reactors, but pressure from the United States led the Belgian government to refuse to allow the company to participate in the construction.

d. Pakistan is having great difficulty finding someone to sell it a reactor. The Soviet Union decided not to sell it one and other suppliers will only do so after Pakistan has placed all its nuclear facilities under safeguards.

e. In 1984 the Spanish government froze construction of five nuclear units until after 1992. The estimate in the table assumes that none of the five plants will be finished by the end of this century.

f. The Soviet Union has agreed to help Syria build a nuclear power plant, Nuclear Engineering International, January 1985, p. 6.

g. A decision to build a pressurized water reactor in Britain has not yet been made. The estimate for the cumulative amount of plutonium assumes that the first reactor begins operation in 1995 and is quickly followed by the operation of three more units this century ("NUKEM Market Report on the Nuclear Fuel Cycle," May 1984, NUKEM, GmbH, Hanau, Federal Republic of Germany).

h. Totals rounded off.

Source: Ibid.

Table 4

Plutonium Discharged in Western Non-Light Water Reactor Spent Fuel
Cumulative Total (metric tons)[a]

Country	Reactor Type	Through 1984	Through 1990	Through 2000
Argentina	Candu	2.0	4.4	13
Canada	Candu	28	63	140
France	Magnox[b]	15	22	30
India	Candu	0.75	3.4	14
Italy	Magnox[c]	2.2	2.7	3
Japan	Magnox[d]	1.7	2.2	3
Korea	Candu	0.5	2.[illegible]	5
Pakistan	Candu	0.3	0.5	1
Spain	Magnox[e]	3.4	4.9	7
United Kingdom	Magnox[f]	39	50	64
	AGR[g]	2.7	8.4	20
TOTALS[h]		96	165	300

References and Comments

a. The cumulative totals ignore reductions in the amount due to the decay of plutonium-241.

b. The estimate of plutonium production in French gas-graphite reactors through 1984 uses a different plutonium discharge rate than the one in table 1. The average burnup of the fuel is assumed to be only 3,000 MWt-d/MTU (for fuel reprocessed at La Hague through 1981 see Nuclear Regulatory Commission translation of Castaing, Raimond _et al_, _Rapport du Groupe de Travail sur la Gestation des Combustibles Irradies_ (France, Ministere de la Recherche et de l'Industrie, 1982) Attachment 4 "Analysis of the Dosimetric Results of the External Exposure," Table VIII). Through 1984 the conversion factor is 810 kg. Pu per GWe (gross) per year (At a fuel burnup of 3,000 MWt-d/MTU the amount of plutonium discharged is about 2 kg. per MTU (_Le Dossier_, op cit. (see footnote f, table 1)). The average thermal efficiency of the reactors is about 0.30 for gross electricity production ("General Information," _Nuclear Engineering International_, October Supplement, October 1984)).

After 1984 the fuel burnup is assumed to be 4,000 MWt-d/MTU and the value in table 1 is used. The gas-graphite reactors are expected to close down in the 1990s. The date when they close is estimated by assuming that each reactor lasts 25 years. The amount of plutonium in the last core is estimated to be 2.0 metric tons of plutonium per GWe (Nuclear Energy Agency, _Nuclear Energy and Its Fuel Cycle_, Prospects to 2025 (OECD, Paris 1982)). This reference lists 1.8 MT of fissile plutonium per GWe. It is assumed that the final fuel has a fairly low burnup and the fissile fraction is crudely estimated to be about 85 to 90 percent.)

c. The Latino gas-graphite reactor operates at a burnup of about 3,000 MWt-d/MTU ("Technical Data," Nuclear Engineering International, October Supplement, October 1984). At this burnup about 2.0 kg Pu are contained in each metric ton of spent fuel (Le Dossier, op. cit.). The thermal efficiency of Latino is about 0.3 for gross electricity production and 0.28 for net electricity production ("General Information, op. cit.). Thus, the plutonium discharge rate is about 810 kg Pu/GWe (gross)-yr and 870 kg. Pu/GWe (net)-yr. It is assumed that Latino will shut down in 1992 after 25 years of operation (see footnote b).

d. The Tokai gas-graphite reactor operates at a burnup of about 3,000 MWt-d/MTU ("Technical Data," op. cit.). The thermal efficiency of this reactor is 0.28 for gross electricity production and 0.27 for net production ("General Information, op. cit.). It is assumed that Tokai will shut down in 1994.

e. The burnup of the Vandellos 1 gas-graphite reactor is estimated to be about 6,000 MWt-d/MTU ("Technical Data," op. cit.) which corresponds to 3.3 kg. Pu per metric ton of uranium (Le Dossier, op. cit.) Its thermal efficiency is 0.27 for net electricity production and 0.28 for gross production ("General Information," op. cit.).

The reactor is jointly owned by France and Spain and all Vandello's spent fuel is shipped back to France where it is reprocessed. The reprocessed plutonium is kept by France.

f. The plutonium discharge rate for gas-graphite reactors in table 1 is used as a basis to compute the plutonium accumulation from British gas-graphite reactors. Because the ratio of total net electricity production to gross electricity production is about 0.85 ("General Information, op. cit.), about 680 kg. Pu are produced per GWe (gross) per year.

Since no more gas-graphite plants will be built, the only unknown in estimating future nuclear capacity is when they will be shut down. Presently, they are expected to last 30 years instead of 25 years as originally estimated (A.W. Clarke and C.J. Marchese, "CEGB Nuclear Station Performance - Current Status," Nuclear Europe, 1/1985, January 1985, pp. 1317). Final cores are estimated to contain 2 metric tons of plutonium per GWe (see footnote b).

g. The advanced gas reactor is only built in the United Kingdom. Its plutonium production rate is about 250 kg. Pu per GWe (net) per year (Official Report of the House of Commons, Hansard, 27 July 1983, column 439). Converting from net to gross electricity production gives a plutonium production rate of about 230 kg. Pu per GWe (gross) per year ("General Information," op. cit.). The date when the facilities under construction begin operation is taken from Atomic Industrial Forum, "AIF International Survey," Bethesda, Maryland, April 17, 1985.

h Total figures are rounded-off.

Source: Ibid.

Table 5
Plutonium Discharged in Spent Fuel from Major Power Reactors in Communist Countries
Cumulative Totals (Metric Tons)

Country	Reactor Type	Through 1984	Through 1990 Lower Estimate	Through 1990 Upper Estimate	Through 2000 Lower Estimate	Through 2000 Upper Estimate
Bulgaria	PWR[a]	1.6	5.5	-	13	15
China, Peoples Republic of[b]	PWR	-	-	-	5.4	6.9
Cuba	PWR	-	0.3	0.5	1.1	2.1
Czechoslovakia[c]	PWR	1.0	5.2	5.2	17	[illegible]0
Germany, East	PWR	2.0	3.8	12	13	17
Hungary	PWR	0.2	2.2	2.2	5.7	5.7
Poland	PWR	-	-	-	3.4	5.6
Romania	Candu	-	0.8	0.8	5.6	6.2
U.S.S.R.[d]	PWR	10	27	38	60	160
	LWGR[e]	14	34	34	74	74[f]
TOTALS[g]		29	79	90	200	300

NOTE: The uncertainties of the values in the table reflect primarily the limited amount of information available about nuclear reactor programs in Communist countries and the oftentimes overly optimistic Soviet forecasts of the number of reactors that will be built. For a general discussion of these problems, see Office of Technology Assessment, Technology and Soviet Energy Availability, November 1981, Washington, D.C.

The amount of plutonium discharged in the spent fuel is derived from an estimate of the electricity production of the reactors. The primary source for the nuclear capacity of the communist countries is the Atomic Industrial Forum, AIF International Survey, April 17, 1985, Bethesda, Maryland. The electricity production in each country is converted into plutonium production by assuming that the capacity factor is 65 percent for all these reactors and by using the conversion factors in table 1. In the case of the pressurized reactors, the plutonium discharge rate is found in footnote c to table 1 and is 310 kg. Pu per MWe (gross) per year at 100 percent capacity.

Two estimates of future plutonium inventories in spent fuel are used: a "lower estimate" that represents reactors operating, under construction, or ordered, and an "upper estimate" that, in addition to the above categories, includes planned reactors. In both cases, reactors are included only if an anticipated date of commercial operation is publicly known.

References and Comments For Table 5

a. Pressurized water reactor, a type of light water reactor.

b. The amount of plutonium estimated to be in Chinese spent fuel assumes that the lower estimate of the nuclear electricity capacity in 2000 will be 4.1 GWe and that the upper one will be 6.1 GWe.

c. The startup dates of several of the reactors under construction in Czechoslovakia has been postponed by several years from the ones in the Atomic International Forum list of reactors.

d. The nuclear capacity for the Soviet Union before 1982 is from B.A. Semenov, "Nuclear Power in the Soviet Union," IAEA Bulletin 25, June 1983, p. 48 and after 1982 is derived primarily from Atomic Industrial Forum, AIF International Survey, April 17, 1985, Bethesda, Maryland. After 1990 the upper estimate for the PWRs includes both the PWRs and the LWGRs. The upper estimate for plutonium accumulation through 2000 assumes that the total nuclear capacity in the Soviet Union will reach 55 GWe by 1990, 75 GWe by 1995, and 100 GWe by 2000 (see footnote f below).

e. Light-water cooled, graphite-moderated, reactor.

f. The number of LWGRs that are planned to be built is not publicly known. Generally, only the total future nuclear capacity is publicly announced, not the number of each type of reactor that will be built. Since it is known that most of the future reactors will be PWRs, it is assumed for the sake of this calculation that all new reactors will be PWRs. This assumption will not affect the total plutonium accumulation for the Soviet Union, because each type of reactor produces almost the same amount of plutonium per GWe per year.

g. Totals rounded off.

Source: Ibid.

Table 6

Reprocessing Capacities of Major Civilian Reprocessors of Power Reactor Fuel[a]

Country	Facility	Type of Reactor Fuel[b]	Year Operational	Capacity (MTU/year)
Argentina	Ezeiza	Oxide (candu)	1988?	5
Belgium	Mol	Oxide (LWR)	1992?	120
Brazil	Resende	Oxide (LWR)	1989	3
France	La Hague			
	UP2	Metal (magnox)	1967-86	800 [c]
		Oxide (LWR)	1976	400 [c]
	UP2-800	Oxide (LWR)	1991 or 92	800
	UP3	Oxide (LWR)	1989	800
	Marcoule UP1	Metal (magnox)	1958	500 [d]
West Germany	Karlsruhe	Oxide (LWR)	1971	20
	Bavaria	Oxide (LWR)	1992	350
India	PREFRE	Oxide (candu)	1979[e]	100
	Kalpakkam[f]	Oxide (candu)	1987?	100
	Western India	Oxide (candu)	?	350
Japan	Tokai Mura	Oxide (LWR)	1977	210 [g]
	Rokkashomura	Oxide (LWR)	1995	800
Pakistan	Chashma	Oxide (candu)	?	100
United Kingdom	Sellafield	Metal (magnox)	1964	2500 [h]
	Thorp	Oxide (LWR&AGR)	1990	1200 [i]

References and Comments For Table 6

a. Unless otherwise noted, the data in this table are compiled from table 7. Some of the capacities in this table are design capacities of the plant. In these cases, more realistic yearly throughputs of fuel are listed in table 7.

b. Many of the reprocessing facilities will process other types of fuel. The above table only lists the main type of spent uranium fuel that is reprocessed at this facility. In addition, only spent fuel that contains significant amounts of plutonium is included

c. Since 1976 both gas-graphite and LWR spent fuel have been reprocessed at the UP2 facility. The values for the fuel capacity refer to the nominal capacity for each type of fuel if only that type was reprocessed during the year. Actual capacities for the last several years are listed in table 7. Breeder reactor fuel has also been reprocessed in UP2.

d. This value is for only power reactor fuel. Fuel from military reactors has also been reprocessed in UP1.

e. From 1979 until sometime in 1982 only metal fuel (probably from the Cirus reactor) was reprocessed. In late 1982 the facility began reprocessing spent fuel from the Rajasthan reactors.

f. This facility will also reprocess breeder reactor fuel.

g. This value is the nominal capacity of Tokai Mura.

h. The actual capacity of the metal reprocessing facility is only about 1,250 MTU per year of civilian power reactor metal fuel (see table 7).

i. The actual average capacity during the first ten years of operation of THORP will be only about 600 MTU per year.

Source: Ibid.

Table 7
Reprocessing Capacities of Major Civilian Reprocessors to 2000
(Albright, 1985)

Country	Facility	Type of Source Fuel	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0	0	0	0	-	-	-	-	-	-	-	-	-	-	[illegible]
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References and Comments For Table 7

a. Cold startup is not expected until mid-1987 and no date has been set for radioactive operation ("Argentina Denies Receiving West German, Italian Reprocessing Know-How," Nucleonics Week, May 30, 1985, p. 4). Initial capacity projections for the plant are 10 to 15 kilograms of plutonium a year or 5 metric tons of spent fuel a year ("Argentina Looks to Reprocessing Plant to Fill Own Needs Plus Plutonium Sales," Nuclear Fuel, November 8, 1982). The plant is designed for relatively easy expansion to an industrial scale.

b. "Synatom Sets Up Belgoprocess," Nuclear Engineering International, May 1985, p. 7 (See also p. 31 "World Survey.") The estimated annual capacity is 120 metric tons of heavy metal a year. The annual capacity during the initial years is estimated. If the plant operates, it would be devoted to reprocessing of Europe's nonstandard fuel, such as the smaller fuel from earlier light water reactors, fuel from other kinds of reactors like the French Monts d'Arree gas-cooled heavy water reactor, and LWR mox fuel. A decision to restart the plant is currently in doubt, because of Belgian utility doubts that reprocessing is economic and lack of foreign interest in contracting for reprocessing services ("Belgians dither over repocessing plant," Nuclear Engineering International, December 1984, p. 13).

c. Nuclear Assurance Corporation, Reprocessing Status Report, Atlanta, Georgia, October 1982.

d. UP2 is being upgraded to reprocess up to 800 tons a year through a project known as UP2-800.

e. J. Megy, "Reprocessing Spent Fuel in France," Nuclear Engineering International, March 1983, pp. 40-42.

f. "Cogema Exceeds Reprocessing Target by 20%," Nuclear Fuel, November 21, 1983, p. 8.

g. Nuclear Fuel, February 25, 1985.

h. Cogema expects to have a capacity at UP2 of 350 MTU/yr rather than 250 MTU/yr sometime in the late 1980s and early 1990s before it is converted into UP2-800 ("Cogema Aiming to Offer Fixed-Price Reprocessing," Nuclear Fuel, January 28, 1985).

i. UP2-800 will become operational in 1991 ("Progress in URG Shareholders' Projects," Reprocessing News, United Reprocessors GmbH, Karlsruhe, Federal Republic of Germany, May 1984, p. 4), although its startup might be delayed one year. Its capacity during the first year is estimated to be 150 tons of spent fuel and will reach its full capacity of 800 tons per year four years later (Nuclear Regulatory Commission translation of Castaing, Raimond et al, Rapport du Groupe de Travail sur la Gestation des Combustibles Irradies (France, Ministere de la Recherche et de l'Industrie, 1982), Attachment 3 (known as the "Castaing Report")). The capacities from 1992 through 1994 are estimates based on a linear increase in capacity from 1991 until 1995.

j. Cogema, Washington, D.C., personal communication, February 1983.

k. Cogema, Washington, D.C., personal communication, 1984.

l. Nuclear Fuel, February 25, 1985.

m. The reprocessing of metal fuel will be transferred to the UP1 plant in Marcoule in 1986. "France: Cogema's 1984 production programme for La Hague," Reprocessing News, United Reprocessors GmbH, May 1984, p. 6.

n. UP3 is scheduled to startup in 1989, "Progress in URC Shareholders' Projects," Reprocessing News, United Reprocessors GmbH, May 1984, p. 4. Another source states that active service is scheduled for mid-1988, "Cogema Profitable in 1983," Nuclear Fuel, July 2, 1984, p. 13. UP3's capacity during its first year is estimated to be 100 tons per year and will reach its full capacity year four years later ("Castaing Report," op. cit., Attachment 3). The capacities from 1989 through 1992 are estimates based on a linear increase in capacity from 1988 through 1992. A Cogema official said to Nuclear Fuel (NF, June 20, 1983) that "the plant should be able to reprocess 920-936 MT per year beginning around 1990, with smaller quantities for the first two years of operation in 1988 and 1989." The increase in capacity to 900 metric tons a year in table 7 above corresponds to Cogema's offer to reprocess 7,000 metric tons of spent fuel rather than 6,000 ("Customers See Little Choice in Cogema 'Offer' of Extra Reprocessing," Nucleonics Week, June 9, 1983).

o. Estimated, but see footnote d in table 11. (See also "Summary of Nuclear Power and Fuel Cycle Data in OECD Member Countries," March 1984, Nuclear Energy Agency, Organization for Economic Co-Operation and Development, p. 17.) Because all magnox fuel will be concentrated at Marcoule after 1986, the UP1 facility is being modified and extended, most notably with the construction of a new spent fuel storage and decladding complex, MAR-400 (A. Cruickshank, "Cogema looks to wider markets," Nuclear Engineering International, September 1984, pp. 30-39).

p. Nuclear Assurance Corporation op. cit. The nominal capacity is 35 metric tons of uranium per year for fuel with 20,000 MWd/MTU and 10 to 15 metric tons per year for fuel with 30,000 MWd/MTU.

q. The reprocessing plant at Karlsruhe was shut down in May

1980 and reopened in late 1982. From the date when the plant was restarted through late June 1983 about 20 metric tons of uranium fuel was reprocessed, "FRG: Successful Operation of the WAK-plant," Reprocessing News, United Reprocessors GmbH, November 1983, p. 3. During late 1983 a small amount of spent fuel from the the nuclear ship "Otto Hahn was reprocessed," "FRG: Successful Operation," op. cit.

r. "DWK Selects Site For Reprocessing Plant," Nuclear Fuel, February 11, 1985, p. 7. I estimate that the capacity will increase in a similar way as the French reprocessing plant UP3 at La Hague. This estimate is consistent with estimates by the German reprocesser, DWK, "Cogema, SGN and DWK Sign Reprocessing Accord," Nuclear Fuel, July 16, 1984, p. 4.

s. The nominal capacity of the plant is about 40-60 metric tons per year. The yearly increase in the capacity is an estimate. Trombay went into operation in 1964 with a nominal capacity of 30 MT per year (Annual Report: 1983-84, Government of India, Department of Atomic Energy, p. 5). This facility supplied the plutonium for the bomb India exploded in 1974 ("India Reprocesses Rapp Fuel Under IAEA Eyes," Nuclear Fuel, February 14, 1983). It was partially decommissioned in 1972. It restarted in late 1984 or early 1985. Spent metallic fuel from the Dhruva reactor (scheduled to start operation in 1985) and Cirus research reactor will be reprocessed at this facility ("The Reprocessing Plant at Trombay is Ready For Recommissioning," Nuclear Fuel, May 9, 1983 and Annual Report: 1983-84, Government of India, Department of Atomic Energy, p. 26). It is estimated in in the main text of the article that about 35 metric tons of fuel will be discharged per year from these reactors. The capacity has been rounded up to 40 metric tons of fuel per year.

t. PREFRE began reprocessing spent fuel from the Rajasthan Atomic Power Station (RAPS) in late 1982 ("India Reprocesses Rapp," op. cit. (but see footnote f in table 11 about metal fuel reprocessed earlier)). From late 1982 through late 1983 about 20 metric tons of RAPS fuel were reprocessed (A. Abraham, "Plutonium Missing in Tarapur Plant," The Sunday Observer (Bombay, India), October 16-22, 1983). The fuel reprocessed had a low burnup and is reported to have contained only 25 kilograms of plutonium (Abraham, op. cit.).

It is possible to derive an upper bound on the annual amount of plutonium that will be seperated at PREFRE. The nominal daily reprocessing capacity of the PREFRE facility is 0.5 tons of uranium per day ("India's Significant Efforts on Reprocessing and Vitrification," Nuclear Europe, 1/83, p. 45-46). Assuming the plant will operate for 300 days a year then it could process up to 150 metric tons of fuel a year. The French discovered that their nominal capacity had to be further reduced by another factor of one third to account for unscheduled shutdowns ("Castaing Report," attachment 1, op. cit.) which results in an annual capacity of 100 MTU.

The amount of plutonium in each metric ton of spent fuel depends on whether it is candu or BWR spent fuel and on the burnup of the spent fuel. If only candu fuel is reprocessed and burnups reach 5,000 to 7,000 MWt-d/MTU, about 3 to 4 kg. of plutonium are contained in each metric ton of fuel ("Heavy Element Concentrations in Power Reactors," SND-120-2, NUS Corporation, Clearwater, Florida, May 1977). Thus, about 300 to 400 kg. of reactor-grade plutonium could be produced each year. If low burnup fuel is reprocessed, about 1 kg of plutonium is contained in each metric ton of fuel and 100 kg. of weapon-grade plutonium can be separated each year.

Besides the difficulty most countries have had achieving nominal reprocessing capacities, there is another problem that India must face in actually reprocessing 100 MTU per year. There might not be sufficient spent fuel to reprocess. The purpose of the Tarapur reprocessing facility is to handle spent fuel from both the Tarapur reactors and the RAPS reactors. However, the yearly discharge from these reactors (under normal operating conditions) is only about 70 metric tons per year of which about 15 to 20 tons is from the reactors at Tarapur (Nuclear Assurance Corporation, Reprocessing Status Report, October 1982, Atlanta, GA).

Moreover, it is unlikely that any Tarapur fuel will be reprocessed. Until 1980 the fuel was supplied by the United States and its reprocessing requires U.S. consent, which India is unlikely to receive. Further, the Tarapur reactors were supplied by the United States and under the U.S./India Agreement for Tarapur, any spent fuel supplied by another supplier would still be subject to U.S. control, although India disputes this part of the agreement. (Since 1984 France has been supplying low enriched fuel to the Tarapur reactors at the request of the United States. This arrangement with France, however, does not affect U.S. control over the spent fuel.)

u. The initial date of operation of the Kalpakkam plant is an estimate as is the projected increase in capacity during the first few years. The nominal capacity of the Kalpakkam facility is about 100 metric tons of spent fuel per year. However, this facility is expected to have two separate reprocessing lines - one to handle spent fuel from the Madras Atomic Power Station (MAPS) and the other to handle fuel from the Fast Breeder Test Reactor (Department of Atomic Energy, Annual Report, 1982-83 and "India Reprocesses Rapp Fuel Under IAEA Eyes," Nuclear Fuel, February 14, 1983). Maps will discharge about 50 metric tons of spent fuel each year (Nuclear Assurance Corporation, op. cit.).

The 40 MWt Fast Test Breeder Reactor (FTBR) is expected to go critical this August ("India first to use mixed carbide fuel," Nuclear Engineering International, May 1985). It will be the first breeder reactor to use mixed uranium-plutonium carbide fuel. Breeding ratios are significantly higher for carbide fuel than the more standard oxide fuel, and thus, the doubling time will be significantly less. A higher breeding ratio also means that more high quality plutonium can be produced in the blanket.

v. The amount reprocessed in 1982 is estimated from the following information. Through June 1981 Japan's Power Reactor and Nuclear Fuel Development Corp. (PNC) reprocessed a cumulative total of 106 metric tons of spent fuel ("PNC to Reprocess 200 tonnes in Two Years at 586,900/tonne in Pact with Utilities," *Nuclear Fuel*, November 23, 1981). From June 1981 until August 1982, PNC reprocessed about 45 metric tons of spent fuel (*Annual Report of the Japanese Atomic Energy Commission - 1982*). Until the reprocessing facility closed down in February 1983, PNC had reprocessed a cumulative total of 170 metric tons of spent fuel (*Reprocessing News*, United Reprocessors GmbH, November 1983).

w. The plant closed down in February 1983. It restarted in February 1985 ("PNC Runs Tokai Reprocessing Plant," *Atoms in Japan*, February 1985, pp. 26-27). In trial runs in February 1983 and in December 1983, PNC reprocessed respectively 1 and 2 tons of BWR fuel ("PNC Fears it Won't Reprocess Substantial Quantities, *Nuclear Fuel*, February 28, 1983, p. 11 and "Tokai Tests Repaired Dissolver," *Nuclear Engineering International*, February 1984, p. 9).

x. "Reprocessing to resume at Tokai Mura," *Nuclear Fuel*, November 26, 1984, p. 9. In order to process the full 140 metric tons in 1986, Japan will have to obtain the approval of the United States. Beginning in 1986 Japan is likely to reprocess between 5 and 10 metric tons of spent mox fuel from its Fugen reactor ("Reprocessing to resume at Tokai Mura," op. cit.). Finally, the capacity for spent fuel storage is to be increased from 97 to 140 metric tons ("PNC Runs," op. cit.)

y. The capacity after 1986 is estimated.

z. "Japan Utilities Bare Plans to Build Fuel-Cycle Facilities at Shimokita," *Nuclear Fuel*, July 30, 1984. The nominal capacity of the plant is planned to be 1,200 metric ton of uranium a year with a working capacity of 600 to 800 metric tons of uranium per year with the plant's startup targeted for 1995 ("Japan Chooses Fuel Cycle Sites," *Nuclear Engineering International*, June 1984, pp. 12-13). The capacity listed in the table above is arbitrarily set at 600 MTU/year. I estimate that the capacity will increase in a similar way as the French reprocessing plant UP3 at La Hague. Plans for this plant might be modified. It is possible that instead of a single reprocessing line, two lines would be built. The second would be built a few years after the first one, depending on need (P. Leventhal, Nuclear Control Institute, personal communication, 1984).

aa. New Laboratory is a small facility located next to the Pinstech Laboratory that can process about 2 to 5 metric tons of spent fuel per year (Thomas W. Graham, "South Asian Nuclear Proliferation and National Security Chronology," Center for International Studies, Massachusetts Institute of Technology, Cambridge, MA). There is no evidence that New Lab has processed any plutonium-containing spent fuel (Graham, op. cit.)

bb. Chashma is a 100 metric ton per year plant currently under construction. Originally, France would have supplied the plant, but the United States stopped the sale. Pakistan has continued to work on the facility with limited success (Nuclear Fuel, March 26, 1984). Pakistan has agreed to a safeguards agreement on Chashma with France and the International Atomic Energy Agency (IAEA). If the facility is completed, whether safeguards will be applied will become an important and highly contentious issue.

cc. Sellafield's (formerly Windscale) nominal capacity is 2500 tons per year. However, its actual capacity is estimated to vary roughly between 1000 and 1500 tons per year (Syndicat CFDT, Le Dossier Electronucleaire (Seuil, 1980) pp. 194, 202, 502 and " British Nuclear Fuels Finds Profits, Pain in Reprocessing," Energy Daily, 29 August 1984, p. 4.) Sellafield needs to reprocess about 1300 metric tons of spent magnox fuel discharged annually from U.K. power stations and 100 to 150 metric tons of spent magnox fuel discharged annually from the Japanese and Italian magnox reactors (S. Rippon, "Reprocessing - What Went Wrong," Nuclear Engineering International, February 1976, p. 25).

dd. Thorp will have a design capacity of 1200 MTU/yr. For planning purposes an annual throughput increasing to 650 MTU/yr during the first ten years of operation is assumed ("Progress in URG Shareholders' Projects," Reprocessing News, United Reprocessors GmbH, Karlsruhe, Federal Republic of Germany, May 1984, p. 3). The date of initial operation is scheduled for late 1990. The plant is not expected to achieve full capacity for several years after start-up. I estimate that the capacity will increase in a similar way as the French reprocessing plant UP3 at La Hague. About one third of the fuel that it reprocesses will be oxide fuel from advanced gas reactors.

Source: Ibid.

Table 8

Plutonium Separated From Light Water Reactor Spent Fuel at La Hague, France Through 1983

Country	Spent Fuel[a] (MT)	Plutonium[b] (kg)
Belgium	83.2	665
France	83.2	665
Germany	348.2	2790
Japan	41.2	250
Netherlands	73.4	590
Switzerland	101.9	820
Total	731.2	5,780

References and Comments

a. M. Delange, "Reprocessing of LWR Spent Fuel at La Hague 1976-1982," Nuclear Europe, 1/1983, January 1983, table 2, p 36 and letter to D. Albright from C. Hutchinson, Cogema, Washington, D.C., January 4, 1984

b. Through 1981 the LWR spent fuel contained on average 8 kilograms of plutonium per metric ton of fuel (9 kg. plutonium per metric ton of uranium) (see footnote c in table 11). In all cases, except for Japan, the former value was used. The actual value could vary. In the case of Japan, the amount that was sent back in 1984 is assumed to be all the plutonium that was extracted from the 41.2 metric tons of spent fuel reprocessed through 1983.

Source: Ibid.

Table 9

Amount of Spent Fuel (MTU) & Plutonium (MT) From Commercial Light Water Reactors Contracted for Reprocessing in France & Britain

Country	France (MTU) UP2[a]	France (MTU) UP3[a]	France (MTU) Extra UP3[b]	Britain (MTU)	Total (MTU)	Plutonium Total (MT)
Belgium	139	398	66	--	603	5.0[c]
Germany	681	2,141	357	750[d]	3929	35.[e]
Italy	-	-	-	190[f]	190	1.5[c]
Japan	151	2,200	367	2,250[h]	4,968	45.[e]
Netherlands	79	120	20	60[f]	279	2.5[e]
Spain	-	-	-	150[f]	150	1.2[c]
Sweden[i]	35	672	112	160[i]	979	8.8[e]
Switzerland	132	469	78	350[j]	1029	9.3[e]
Total	1,237	6,000	1,000	3,890	12,127	108

References and Comments

a. A. Cruickshank, "Cogema looks to wider markets," Nuclear Engineering International, September 1984, pp. 33-39. All the spent fuel will be reprocessed at La Hague. The fuel contracted to be reprocessed in the UP2 facility is currently being reprocessed. The reprocessing of the spent fuel in the UP3 facility will begin in the late 1980s.

b. Cogema has announced that it intends to reprocess 7,000 tons of spent fuel under the UP3 contracts. The extra amounts are assigned to a country in proportion to the original amount this country contracted for reprocessing.

c. The spent fuel is estimated to contain about 8 kg. of plutonium per metric ton.

d. E. Leyser, "The Back End of the Nuclear-Fuel Cycle in the Federal Republic of Germany," in The World Nuclear Fuel Market, Proceedings of the 11th International Conference on Nuclear Energy, Florence, Italy, October 14-16, 1984, p. 152. Most of the spent fuel contracted for reprocessing in Britain was contracted in 1983 when Germany agreed to reprocess 722 metric tons at THORP (P. Wahlen, "BNFL's Additional Reprocessing Deals With Swiss, Germans, and Italians," Nuclear Europe, 3/1983).

e. The spent fuel is estimated to contain 9 kg. of plutonium per metric ton.

f. C. Braun, "Rationale for Low Cost Plutonium Fuel," paper presented at the American Nuclear Soceity Annual Meeting, New Orleans, Louisiana, June 3-7, 1984. Braun lists the total amount of spent fuel contracted by each country. He apparently does not include the extra 1,000 metric tons of uranium which will be reprocessed in UP3. Except for this difference, the amount in Braun's table agrees reasonably well with the quantities in the above table for Belgium, Germany, Japan, Sweden, and Switzerland.

g. Japan has signed LWR spent fuel reprocessing contracts with Britain and France covering about 4,600 metric tons ("Japan Eyes Interim Storage Alternatives," Nuclear Fuel, December 3, 1984). Subtracting the amount contracted for reprocessing in France (not including the extra fuel to be reprocessed under the UP3 contracts) leaves 2,350 metric tons.

h. Sweden has decided to drop all its reprocessing contracts. They will probably be taken over by Japan and West Germany.

i. "Germans and Japanese Will Take Over Swedish Reprocessing Contracts," Nuclear Fuel, May 21, 1984.

j. Switzerland has signed contracts to reprocess 950 metric tons of spent fuel (P. Hahlen, op. cit.). Subtracting the amount contracted for reprocessing in France (not including the extra fuel to be reprocessed under the UP3 contracts) leaves 350 metric tons.

Source: Ibid.

Table 10

Amount of Plutonium Separated From Civilian Power Reactor Fuel by Major Reprocessors (Through 1984)

Country	Facility	Fuel Type[a]	Amount (kg)
Belgium	Eurochemic-Mol	metal & oxide	683[b]
France	La Hague	oxide	7,900[c]
		metal	7,220 to 7,480[d]
	Marcoule	metal	4,000[d]
			19,120-19,380
Germany, West	Karlsruhe	oxide	840[e]
India	PREFRE	oxide and metal	?[f]
Japan	Tokai-Mura	oxide	1,040[g]
USA	West Valley	oxide	1,330[h]
	Savannah River Plant	oxide	165[i]
	Hanford	oxide	?[j]
United Kingdom	Windscale	metal domestic	32,000[k]
		metal foreign	3,500[l]
		oxide	300[m]
			35,800
		Total	39,000[n]

References and Comments For Table 10

a. The types of fuel reprocessed commercially are oxide fuels from LWRs and Candus and metal fuels from Magnox or gas-graphite reactors.

b. Syndicat CFDT de l'Energie Atomique, *Le Dossier Electronucleaire* (Editions du Seuil, 1980), p. 202, 203. The facility was closed down in 1974, although it might be restarted in the early 1990s. A small fraction of the plutonium was produced in non-power reactors.

c. Through 1984, 986 metric tons (MT) of oxide fuel were reprocessed at La Hague, Cogema, Washington D.C., January, 1985. Through 1981, 8 kilograms of plutonium were contained in each metric ton of fuel or 9 metric tons in each ton of uranium reprocessed at La Hague (Nuclear Regulatory Commission translation of Castaing, Raimond *et al*, *Rapport du Groupe de Travail sur la Gestation des Combustibles Irradies* (France, Ministere de la Recherche et de l'Industrie, 1982), "Attachment 1, "Reprocessing Capacity of UP3 (Pressurized Water) and of HAO: Past, Present, Future," table 3 (also known as the "Castaing Report")). The average burnup of the spent fuel was 23,000 MWt-d/MTU ("Castaing Report," Attachment 4, "Analysis of the Dosimetric Results of the External Exposure," table VIII). The average burnup of the spent LWR fuel in 1982 and 1983 was, respectively, 21,000 and 23,000 MWt-d/MTU (Cogema, Paris, personal communication, June 1984). According to the same COGEMA source, the burnups of foreign spent fuel, the main type reprocessed, were expected to increase. But, through 1984 the average plutonium content of the spent fuel is estimated to remain about 8 kg. of plutonium per ton of spent fuel.

d. Through 1984, 4641 MT of commercial metal fuel were reprocessed at La Hague (Cogema, Washington, D.C., February 1983 and April 1984, French Embassy, Washington, D.C., February 1983, and *Nuclear Fuel*, February 25, 1985, p. 12). From the mid-1960s through 1981, 4,113 metric tons of metal fuel were reprocessed at La Hague and contained on average 1.5 kilograms plutonium per metric ton of fuel ("Castaing Report," Attachment 1, op. cit. This quantity of plutonium corresponds to an average burnup of 2,000 MWt-d/MTU (*Le Dossier*, op. cit.), although the average burnup listed in the "Castaing Report" for the fuel is 2,600 MWt-d/MTU (Atachment 4, table VIII, op. cit.). In recent years the burnup of the spent fuel processed at La Hague has been about 3,000 to 4,000 MWt-d/MTU, which corresponds to about 2 to 2.5 kilograms plutonium per metric ton of spent fuel (*Le Dossier*, op. cit., p. 51). Consequently, the spent fuel reprocessed through 1981 - 4,113 MT of spent fuel- contains 6,170 kilograms of plutonium and after 1981 - 528 MT of spent fuel - contains about 1,050 to 1,310 kilograms of plutonium.

Through 1982, 1,358 metric tons of commercial metal fuel were reprocessed at Marcoule, COGEMA, Washington, D.C., personal communication, 1983. According to *Nuclear Fuel* (NF, December 31, 1984) slightly under 7,000 MTU of gas-graphite spent fuel will have been reprocessed at Marcoule and La Hague through the end of 1984. Subtracting from this value the amount of fuel reprocessed at La Hague and the amount reprocessed through 1981 at Marcoule leaves 1,000 metric tons of spent fuel reprocessed at Marcoule in 1983 and 1984. It is assumed that the burnup of the fuel reprocessed at Marcoule is similar to the fuel reprocessed at La Hague. In this case, however, the fuel reprocessed through 1982 is assumed to contain 1.5 kg. Pu per metric ton and after 1982 is assumed to contain 2 kilograms of plutonium per metric ton.

Fuel from the West German KKN reactor (gas-cooled heavy water reactor) and from the French EL-4 reactor was also reprocessed at Marcoule (*Le Dossier*, op. cit., p. 186), but the amount of plutonium recovered from these reactors is within the error of the total amount separated at Marcoule.

NOTE: Military spent metal fuel has also been reprocessed at Marcoule. Through 1982, about 12,000 metric tons of metal fuel were reprocessed at Marcoule (J. Megy, "Reprocessing Spent Fuel in France," *Nuclear Engineering International*, March 1983, pp. 40-42). If the 1,358 metric tons of civilian metal fuel is subtracted, about 10,640 metric tons of military fuel has been reprocessed at Marcoule.

The authors of *Le Dossier Electronucleaire* (p. 186) estimated that through 1977 about 9,910 tons of metal fuel from the military reactors G1, G2, and G3 were reprocessed. They list the burnup of the spent fuel as between 100 and 1,200 MWt-d/MTU with an average burnup of about 400 MWt-d/MTU. A maximum estimate of the amount of weapon-grade plutonium produced can be derived by assuming that it was all produced in G2 and G3. It is an overestimate, because the G1 fuel is also included in the total amount reprocessed and it contained significantly less plutonium per metric ton of uranium than the G2 and G3 reactors. In any case, at the an average burnup of 400 MWt-d/MTU, G2 and G3 each will produce about 80 kg of Pu per full power year and will require about 230 MTU per full power year (S.E. Turner, et al, Southern Science Applications, Inc, "Criticality Studies of Graphite-Moderated Production Reactors, : Report SSA-125, prepared for US Arms Control and Disarmament Agency, January 1980, figure 2.3 and figure 2.7). Thus, the average amount of plutonium in the spent fuel is about 0.35 kg. Pu per metric ton of uranium. Thus, a maximum estimate of the amount of military plutonium produced is 3.4 metric tons.

The G1 reactor ran at a very low burnup (about 100 MWt-d/MTU) and only produced about 10 kg. of plutonium each full power year while it required about 100 metric tons of uranium each full power year (Turner, op. cit.). G1 ran for about 12 years, so at a burnup of 100 MWt-d/MTU, it would have discharged about 800 MTU if it ran 70 percent of the time and would have produced about 80 kilograms of plutonium. The net effect of including Cl into the calculation is to lower the amount of plutonium produced in the "G" reactors to about 3.2 metric tons of plutonium.

e. A total of 540 kilograms of plutonium were separated at Karlsruhe through 1980 (H.W. Wennies and B. Kucera, "Construction and Use of Pilot Plants in the Karlsruhe Nuclear Research Center," KfK-Nachrichten, Year 13, no. 3-4, 1981, p. 203). Most of it was from reactors that produced electric power (author unknown, KfK-Bericht 3113, Karlsruhe Research Center, April 1981, p. 98.) The plant was closed from May 1980 until late 1982. In 1983 about 20 metric tons of fuel with average burnups from 10,000 to 28,000 MWt-d/MTU were reprocessed (Reprocessing News, United Rerocessors, GmbH, Karlsruhe, Federal Republic of Germany, November, 1983, p. 3). I estimate that another 20 metric tons were reprocessed in 1984. If all of it was power reactor fuel with an average burnup near 20,000 MWt-d/MTU, roughly 300 kg. of plutonium were recovered (see KfK-Bericht 3113, op. cit. for plutonium production data).

f. India began reprocessing commercial spent fuel from the Rajasthan Atomic Power Station 1 (RAPS-1) reactor at its PREFRE facility in late 1982 under International Atomic Energy Agency safeguards ("India Reprocesses RAPP Fuel Under IAEA Eyes," Nuclear Fuel, February 14, 1983, p. 12). Until late 1983 about 20 metric tons of RAPS spent fuel were reprocessed (A. Abraham, "Plutonium Missing in Tarapur Plant," The Sunday Observer (Bombay, India), October 16-22, 1983). The fuel reprocessed had a low burnup and is reported to have contained only 25 kilograms of plutonium (Abraham, op. cit.). The facility as of mid 1984 is in operation and continues to separate RAPS-1 spent fuel ("Commissioning of Vitrification Facility Affirms India's Self-Sufficiency Claims," Nuclear Fuel, June 3, 1985, pp. 9-11.).

Prior to processing RAPS fuel, metal fuel, evidently from the Cirus reactor, was processed in three separate campaigns starting in 1979 (Reference to these campaigns and the starting date of the facility are in Government of India, Department of Atomic Energy, Annual Report 1980-1981, p. 4 and 31, and Annual Report 1981-82, p. 26, and Annual Report 1983-84, p. 6 and 31.)

g. Through March 1983 Tokai had reprocessed a total of 172 metric tons of spent oxide fuel and recovered 1040 kilograms of plutonium, "Japan makes plans for reprocessing," Nuclear Engineering International, July 1984, pp. 20-21. The plant did not operate through most of 1983 and all of 1984.

h. The total amount of plutonium separated at West Valley, which operated from 1966 - 1972, was 1886 kilograms, G.I. Rochlin et. al., "West Valley: Remnant of the AEC," Bulletin of the Atomic Scientists, January 1978, p. 23, table 2. About 550 kilograms of the separated plutonium are from spent metal fuel from the Department of Energy's N-reactor at Hanford, Washington which is a military reactor presently producing weapon-grade plutonium for nuclear weapons.

i. In 1963 spent fuel from the Dresden 1 and the Yankee-Rowe reactors was reprocessed at the military reprocessing plant at the Savannah River Plant (Atomic Energy Commission, Annual Report to Congress of the Atomic Energy Commission for 1964, 89th Congress, 1st Session, Senate Document No. 8, January 1965, table 4). The plutonium in the spent fuel was owned by the government, as was all special nuclear material until 1964 when Congress amended the Atomic Energy Act of 1954 to permit private ownership of these materials. The reactors owners, however, were compensated for the plutonium. Almost all of the plutonium from these power reactors was fuel-grade plutonium.

j. The blanket from the first core of the Shippingport reactor might have been reprocessed at the military reprocesing facility at Hanford, Washington in the 1960s or early 1970s. The first two cores of the Shippingport reactor had highly enriched uranium seeds and a natural uranium blanket. The blanket of the first core contained about 70 kg. of fuel-grade plutonium. The blanket from the second core contained about 100 kg. of plutonium (Edison Electric Institute, "Plutonium Survey - 1964," EEI Pub. No. 65-41, June 1965, table B1) and was being stored at Hanford in the early 1980s. It might have already been reprocessed.

k. As of the end of March 1983, a publicly announced quantity totaling 23,000 kilograms of plutonium had been separated from Central Electricity Generating Board (CEGB) and South of Scotland Electricity Board (SSEB) metal fuel (Answer by the Secretary for Energy to Mr. Lester, MP, on plutonium production, Hansard (record of the House of Commons in the United Kingdom), 27 July 1983, p. 440). Another classifed amount of plutonium separated from CEGB and SSEB metal fuel is estimated to be 4 MT (C. Norman, "Congress, DOE Battle Over British Plutonium," Science vol. 224, 27 April 1984, pp. 365-366). Another estimate using detailed information about the burnup of the fuel from the civil magnox reactors estimates that about 6 to 7 metric tons was exported to the United States (K.W.J. Barnham, D. Hart, and R.A. Stevens, "The Production and Destiny of UK Plutonium," submitted to Nature). The amount was classified since it was part of a defense exchange agreement between the U.K. and the U.S. The agreement permitted the U.K. to obtain from the United States highly enriched uranium and tritium for its weapons program in exchange for civil plutonium from CEGB magnox reactors.

From March 1983 through 1984 it is estimated that 2,000 metric tons of metal spent fuel from British reactors were reprocessed. This estimate assumes that in total 1,250 metric tons of spent fuel were reprocessed each year (see table 7) of which roughly 200 tons was from the Italian and Japanese gas-graphite reactors (see below). Two hundred tons corresponds to the reprocessing of two years worth of spent fuel from these reactors ("Technical Data," *Nuclear Engineering International*, October Supplement, October 1984). Each metric ton of spent fuel from British reactors is estimated to contain 2.5 kilograms of plutonium, which roughly corresponds to fuel with a burnup of 4,000 MWd/MTU (*Le Dossier*, op. cit.)

l. Spent fuel from Italy and Japan has also been reprocessed at Windscale. Nuclear Assurance Corporation has estimated that through 1982 about 1,500 kg. of fissile plutonium have been recovered from Italian fuel and about 1,000 kg. of fissile plutonium have been recovered from Japanese fuel (Nuclear Assurance Corporation, "Near-Term Plutonium Market Outlook," Prepared for the Department of Energy, ORNL/Sub/83-40111/1, March 1983). The burnup of the fuel is estimated to be about 3,000 MWt-d/MTU ("Technical Data," op. cit.), so about 85 percent of the plutonium is fissile. Thus, the total amount of plutonium recovered through 1982 is about 3,000 kg. In the same report Nuclear Assurance Corporation also estimated that about 340 kg. and 140 kg. of fissile plutonium would be recovered from, respectively, Italian and Japanese fuel. The total amount of plutonium recovered is 550 kg. If only 200 metric tons was processed in 1983 and 1984, as estimated above, then only 400 kg. of plutonium would have been recovered.

Not all the plutonium recovered from foreign spent fuel has necessarily been returned to the customers. Until 1981, 1930 kilograms of plutonium were exported and returned to BNFL's overseas customers. The countries to which this plutonium was exported (in shipments larger than gram quantities) are: Belgium, Canada, France, W. Germany, Italy, Japan, and the U.S., *Transcript of Proceedings, Sizewell B Public Inquiry*, 17 March 1983, p. 70.

m. About 90 metric tons of oxide spent fuel were reprocessed at Windscale in the early 1970s (P.J. Mellinger, K.M. Harmon, L.T. Lakey, "A Summary of Nuclear Fuel Reprocessing Activities Around the World," PNL-4981, Prepared for the Department of Energy, Pacific Northwest Laboratory, p. 50). Nuclear Assurance Corporation stated that 56 metric tons of this oxide fuel were from LWRs and that the LWR spent fuel was estimated to contain 237 kilograms of fissile plutonium, which corresponds to roughly 300 kilograms of plutonium (Nuclear Assurance Corporation, op. cit.). The amount of plutonium in the rest of this spent fuel is unknown.

n. The value is rounded-off.

Source: Ibid.

Table 11
Source and Amount of Separated Plutonium in Various Countries Through the year 2000[a]
(metric tons of plutonium)

Country	Separated Plutonium From Foreign Reprocessing Through 2000		Separated Plutonium From Domestic Reprocessing Through 2000		Total Amount Of Plutonium Separated Through The Year 2000
	LWR Fuel	Magnox Fuel	LWR Fuel	Other Fuel	
Argentina	-	-	-	0.2[b]	0.2
Belgium	5	-	?[c]	-	5
Brazil	-	-	0.3[d]	-	0.3
France	-	-	48-73[e]	37[f]	85-110
Germany	35	-	25[g]	-	60
India	-	-	?	5[h]	5
Italy	1.5	3	-	-	4.5
Japan	45	3	37[i]	-	85
Netherlands	2.5	-	-	-	2.5
Pakistan	-	-	-	?	?
Spain	1.2	-[j]	-	-	1.2
Sweden	8.8[k]	-	-	-	8.8
Switzerland	9.3	-	-	-	9.3
United Kingdom	-	-	-	73[l]	73
Total	108	6	113-138	116	360-365

References and Comments

a. The sources for table 11 are primarily tables 6, 7, 9, and 10.

b. The plutonium will be extracted from candu fuel. The spent fuel is estimated to contain 3 kg. of plutonium per metric ton of uranium.

c. I assume that the reprocessing facility in Belgium will not be restarted.

d. The light water reactor spent fuel, which will be reprocessed, is estimated to contain 8 kg. of plutonium per metric ton of uranium.

e. The range in the amount of plutonium separated from French light water reactor spent fuel results from the uncertainty in the amount of spent fuel contracted for reprocessing by the French electricity company. The lower estimate assumes that only 5,426 metric tons of uranium have been contracted for reprocessing (A. Cruickshank, "Cogema looks to wider markets," Nuclear Engineering International, September 1984, pp. 33-39. The upper estimate assumes that about 8600 MTU will be reprocessed through 2000. The latter estimate is derived by totaling the amount of LWR spent fuel reprocessing capacity at La Hague (the amount from 1984 through 2000 is from table 7 and the amount reprocessed through 1984 is 986 MTU) and subtracting the known amount of capacity reserved or planned for foreign spent fuel (about 9,200 MTU).

f. The amount of plutonium that will be separated from gas-graphite fuel in France includes the plutonium from the Spanish gas-graphite reactor.

g. The spent fuel to be reprocessed in the future is estimated to contain 9 kg. plutonium per metric ton of uranium.

h. The candu fuel reprocessed in India is estimated to contain 3 kg. of plutonium per metric ton of uranium. Included in the amount listed in the table is roughly 600 kilograms of weapon-grade plutonium extracted from research reactor spent fuel.

i. The fuel reprocessed at the new facility is estimated to contain 9 kg. of plutonium per metric ton of uranium. The fuel that will be reprocessed at Tokai Mura is estimated to contain only 7 kg. of plutonium per metric ton of uranium.

j. The plutonium from the Spanish gas-graphite reactor is sent to France.

k. Sweden is planning to drop its reprocessing contracts. They will probably be taken over by Germany and Japan.

l. Most of the British inventory of plutonium is from its gas-graphite reactors. But about 9 metric tons of plutonium will be separated at THORP from about 2,000 metric tons of advanced gas reactor spent fuel.

Source: Ibid.

SPENT FUEL STORAGE CAPACITIES AND ARISINGS IN OECD COUNTRIES TO 2000

A) Spent Fuel Storage Capacities

(Tonnes HM)

	1983 (actual)	1984 (actual)	1985	1990	1995	2000
Belgium	600	1 150	1 150	1 450	1 450	1 450
Canada	19 760	19 760	19 760	30 600	34 700	34 700
Finland	480	480	700	1 150	2 100	2 100
France	9 775	10 000	13 900	19 300	22 650	26 250
Germany, F.R.	2 000	4 500	5 100	8 200	8 200(1)	9 000(1)
Italy	450	450	450	1 202	2 216	4 582
Japan	3 497	4 197	7 297	7 300(2)	10 300(2)	10 300(2)
Netherlands	87	87	87	87	87(3)	87(3)
Spain	571	1 995	2 194	6 304	6 304(2)	6 304(2)
Sweden	800	800	4 200	4 500	7 500	7 500
Switzerland	550	550(2)	800	800	800	1 000
Turkey	0	0	0	0	1 100	2 200
United Kingdom	4 065	4 065	5 400(2)	9 200	9 100(2)	9 050
United States	43 700	47 750	52 000	72 100	76 160	77 840
OECD Total	86 000	96 700	114 000	163 000	183 000	192 000

B) Spent Fuel Arisings

(Tonnes HM)

	1983	1984	1985	1990	1995	2000
(Annual Arisings)						
Belgium	37	87	91	133	155	155
Canada	830	1 000	1 100	1 800	2 140	2 140
Finland	62	62	65	65	80	80
France (4)	200(2)	200	300	700	950	1 190
Germany, F.R.	300	400	400	600	600	650
Italy	26	26	38	26	150	270
Japan	530	700	605	850	1 300	1 600
Netherlands	16	12	12	15	45	75
Spain	110	150	150	200	230(5)	240(5)
Sweden	100	200	225	275	275	275
Switzerland	60	60	85	85	85	110
Turkey	0	0	0	0	100	200
United Kingdom (6)	830	775	775(2)	775	450(2)	75
United States	1 116	1 152	1 251	2 334	2 733	3 015
OECD Total	4 200	4 000	5 200	7 400	9 300	10 000
Cumulative Arisings OECD Total (7)	4 200	9 100	14 200	47 100	90 100	138 000

1. Low projection.
2. Secretariat's estimate.
3. Excluding plans for new nuclear generating capacity.
4. LWR only.
5. Data from 1984 Brown Book.
6. Non-governmental forecasts. Provisional number for the year 1984.
7. Since 1983.

Source: Summary of Nuclear Power and Fuel Cycle Data, OECD/NEA, 1985, p. 17.

REPROCESSING CAPACITIES IN OECD COUNTRIES

(Tonnes HM)

	Fuel Type	1983	1984	1985	1990	1995	2000
Belgium	LWR	-	-	-	-	120	120
France	LWR	220	220	250	600	750	750
	GCR	300	300	500	500	500	500
	FBR	1.6	1.6	5	5	5	5
Germany	LWR	16	16	16	16	350	350
Japan	LWR	210	210	210	210	1 010	1 010
	FBR	-	-	-	-	12	12
United Kingdom (1)	LWR	-	-	-	1 200	1 200	1 200
	Magnox	1 500	1 500	1 500	1 500	1 500	1 500
OECD Total		2 250	2 250	2 480	4 030	6 450	6 450

1. Non-governmental forecasts.

Source: Summary of Nuclear Power and Fuel Cycle Data, OECD/NEA, 1985, p. 18.

(Braun, 1984)

Reprocessing Capacities of the Western World (tonnes U/a)

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Belgium																		
Belgoprocess								60	90	120	120	120	120	120	120	120	120	120
Federal Republic of Germany																		
WAK	10	10	10	10	10	10	10	10	10	10								
WA 350											50	100	350	350	350	350	350	350
France, Cogema La Hague																		
UP-2	221	230	250	250	250	300	420	580	660	750	800	800	800	800	800	800	800	800
UP-3A							150	400	700	900	900	900	900	900	900	900	900	900
Japan, PNC																		
Tokai Mura	100	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150
United Kingdom BNFL, Sellafield																		
THORP								100	200	300	400	500	600	600	600	600	600	600
Total	331	390	410	410	410	460	730	1,300	1,810	2,230	2,420	2,570	2,920	2,920	2,920	2,920	2,920	2,920

Source: Braun, Chaim. Rationale for Low Cost Plutonium Fuel. American Nuclear Society Paper. June 1984.

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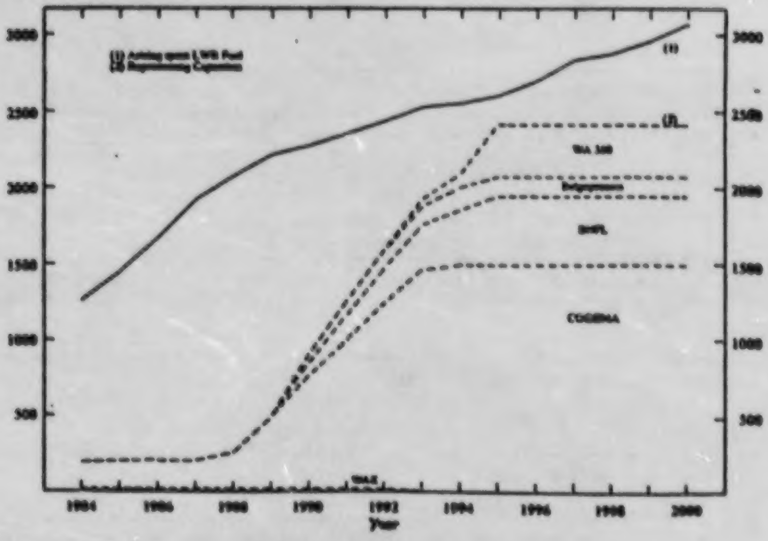
(Braun 1984)

Spent Fuel and Reprocessing Capacities of Western Europe (tonnes U)



Source: Braun, Chaim. Rationale for Low Cost Plutonium Fuel. American Nuclear Society Paper. June 1984.

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(Braun 1984)

Current National Reprocessing Commitments

	Reprocessing Contracted Quantity (MT)	Percent Fuel Discharge Through 1990 Contracted for Reprocessing	Spent Fuel Reprocessor
Belgium	342	44	Cogema
France	6404	100	Cogema, Mol
Germany	3673	78	BNFL, Cogema, DWK, WAK
Italy	786	35	BNFL, Eurex, WAK
Japan	4605	--	BNFL, Cogema
Netherlands	362	100	BNFL, Cogema, Mol
Spain	134	11	BNFL
Sweden	664	34	BNFL, Cogema
Switzerland	1013	99	BNFL, Cogema
United Kingdom	2136	100	BNFL
	19785		

Source: Braun, Chaim. Rationale for Low Cost Plutonium Fuel. American Nuclear Society Paper. June 1984.

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EXPERIENCE WITH PLUTONIUM RECYCLE
(Bairiot 1984)

Table 1. Experience with plutonium recycle in LWRs

Power plant	Design and safety analysis	Plutonium fuel fabrication
PWR		
Saxton	W	W
BR3	BN	BN
Trino	W	W
CNA	BN	BN
CNA	FRA	Alkem
Mihama 1	W – MHI	W
KWO	KWU	Alkem
Beznau 1	W	W
San Onofre 1	W	W
GKN 1	KWU	Alkem
Tihange 1	BN	–
Bugey	EdF	–
Biblis	KWU	–
BWR		
VAK	KWU	Alkem
Dodewaard	BN – GKN	BN
Big Rock Point	ENC	ENC
Garigliano	GE	BN
Dresden 1	GUNF (UNC)	UNC – Alkem
KRB1	KWU	Alkem
KWL	KWU	Alkem
Oskarshamn 1	ASEA	BN
Quad Cities	GE	GE
KKI	KWU	–
Caorso	ENEL	–
KRB 2	NIS	–

W – Westinghouse; BN – Belgonucleaire; FRA – Framatome; MHI – Mitsubishi Heavy Industries; GKN – Gemeenschappelijke Kernenergiecentrale Nederland; ENC – Exxon Nuclear; GUNF – Gulf United Nuclear Fuels; UNC – United Nuclear; NIS – Nuklear-Ingenieur-Service.

Table 2. KWU-Alkem and Belgonucleaire experience with Mox fuel in thermal reactors

Mox fuel fabrication	KWU-Alkem	Belgonucleaire
Number of inserted fuel assemblies	202	170
Per cent in:		
PWRs	17	62
BWRs	79	36
HWRs	4	2

Table 3. High burn-up experience on Mox fuel in power reactors (status March 1983)

Type of fuel	Power plant	Fuel supplier	Burn-up (MWd/kgM) Assembly	Burn-up (MWd/kgM) Peak pellet
PWR 15 × 15	BR3	BN	51	71
	KWO	KWU	35	41
PWR 17 × 17	BR3	BN	39	50
PWR 16 × 16	BR3	BN	38	46
BWR	Dodewaard	BN	36	37
	Big Rock Point	ENC	39	51
	Quad Cities 1	GE	24	34

Source: H. Bairiot. Nuclear Engineering International, Jan. 1984, p. 27

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NUCLEAR EXPORTS AND ASSISTANCE

CONTENTS

Page

Introduction 453

U.S. list of agreements for peaceful nuclear cooperation (Department of State, 1985) 454

IAEA supply agreements (Department of State, 1985) 456

Nuclear power plant imports: World profile (IAEA, 1984) 459

Types of nuclear reactor imports, 1984 (IAEA, 1984) 460

Nuclear power plant imports by reactor type, 1983 (IAEA, 1984) 461

Export-Import Bank of the United States. Authorizations for nuclear power plants and training centers. Summary by country and by year. (Exim Bank, 1984) 462

Summary of exports of enriched uranium, plutonium and deuterium for the period January 1, 1983 through June 30, 1984 (DOE, 1984) 464

Dual-use, Nuclear-related items licensed by Commerce (GAO, 1983) 467

Thirty-six top buyers of dual-use, nuclear-related equipment, July 1, 1981 to June 30, 1982 (GAO, 1983) 468

Nuclear export policies of major supplier countries (Walker and Lonnroth, 1983) 469

Nuclear exports subject to Government control (CRS-1984) 470

Communications received from members regarding the export of nuclear material and of certain categories of equipment and other material (IAEA, 1974) 471

Announcement of identical policies on nuclear export: Communications by 15 member Governments of the IAEA (IAEA press release, 1978) 479

Communications received from certain member States regarding guidelines for the export of nuclear material, equipment or technology ("The Nuclear Supplier Guidelines") (IAEA, 1978) 481

NUCLEAR EXPORTS AND ASSISTANCE

INTRODUCTION

Over the past decade, many have redefined proliferation to include the spread of the ability to produce fissionable materials. With this definition in mind, increasing attention has been given to the implications of nuclear trade and cooperation and its regulation. Indeed, nuclear supply has become probably the most heavily regulated area of international commerce.

In the 1960's the United States was the dominant supplier of nuclear technology to the Western nations. Since then France and West Germany have become strong competitors, Japan is rapidly becoming one, and Canada and the United Kingdom are entering the market.

UNITED STATES LIST OF AGREEMENTS FOR PEACEFUL NUCLEAR COOPERATION

Agreement	Date Signed	Effective Date	Termination Date	Citation
Argentina	June 25, 1969	July 25, 1969	July 24, 1999	TIAS No. 6721, 20 UST 2587
Australia	July 5, 1979	January 16, 1981	January 15, 2011	TIAS No. 9893, - UST -
Austria	July 11, 1969	January 24, 1970	-	TIAS No. 6815, 21 UST 10
- amendment	June 14, 1974	October 8, 1974	January 23, 2014	TIAS No. 7912, 25 UST 2337
Bangladesh	September 17, 1981	June 24, 1982	June 23, 1992	TIAS No. 10339, - UST -
Brazil	July 17, 1972	September 20, 1972	September 19, 2002	TIAS No. 7439, 23 UST 2477
Canada	June 15, 1955	July 21, 1955	-	TIAS No. 3304, 6 UST 2595
- amendment	June 26, 1956	March 4, 1957	-	TIAS No. 3771, 8 UST 275
- amendment	June 11, 1960	July 14, 1960	-	TIAS No. 4518, 11 UST 1780
- amendment	May 25, 1962	July 12, 1962	-	TIAS No. 5102, 13 UST 1400
- amendment	April 23, 1980	July 9, 1980	January 1, 2000	TIAS No. 9759, 32 UST 1079
Colombia	January 8, 1981	September 7, 1983	September 6, 2013	TIAS No. 10722, - UST -
Egypt	June 29, 1981	December 29, 1981	December 28, 2021	TIAS No. 10208, - UST -
European Atomic Energy Community (EURATOM) 1/	May 29 & June 18, 1958	August 27, 1958	-	TIAS No. 4091, 9 UST 1116
- "Joint Program" Agreement	November 8, 1958	February 18, 1959	-	TIAS No. 4173, 10 UST 75
- amendment	May 21 & 22, 1962	July 9, 1962	December 31, 1985	TIAS No. 5103, 13 UST 1483
- Additional Agreement	June 11, 1960	July 25, 1960	-	TIAS No. 4650, 11 UST 2589
- amendment	May 21 & 22, 1962	July 9, 1962	-	TIAS No. 5104, 13 UST 1439
- amendment	August 22 & 27, 1963	October 15, 1963	December 31, 1995	TIAS No. 5444, 14 UST 1459
- amendment	September 20, 1972	February 28, 1973	-	TIAS No. 7566, 24 UST 472
Finland 2/	April 8, 1970	July 7, 1970	July 6, 2000	TIAS No. 6896, 21 UST 1368
India	August 8, 1963	October 25, 1963	October 24, 1993	TIAS No. 5446, 14 UST 1484
- waiver of certain obligations	November 30, 1982	November 30, 1982	-	TIAS No. 10614, - UST -
Indonesia	June 30, 1980	December 30, 1981	December 29, 1991	TIAS No. 10219, - UST -
International Atomic Energy Agency (IAEA) 3/	May 11, 1959	August 7, 1959	-	TIAS No. 4291, 10 UST 1424
- amendment	February 12, 1974	May 31, 1974	August 6, 2014	TIAS No. 7852, 25 UST 1199
- amendment	January 14, 1980	May 6, 1980	-	TIAS No. 9762, 32 UST 1143
Japan	February 26, 1968	July 10, 1968	-	TIAS No. 6517, 19 UST 5214
- amendment	February 24, 1972	April 26, 1972	-	TIAS No. 7306, 23 UST 275
- amendment	March 28, 1973	December 21, 1973	July 9, 2003	TIAS No. 7758, 24 UST 2323
Korea	November 24, 1972	March 19, 1973	-	TIAS No. 7583, 24 UST 775
- amendment	May 15, 1974	June 26, 1974	March 18, 2014	TIAS No. 7842, 25 UST 1102
Morocco	May 30, 1980	May 16, 1981	May 15, 2001	TIAS No. 10018, - UST -
Norway	January 12, 1984	July 2, 1984	July 1, 2014	TIAS No. - , - UST - 4/
Peru	June 26, 1980	April 15, 1982	April 14, 2002	TIAS No. 10308, - UST -

Agreement	Date Signed	Effective Date	Termination Date	Citation
Philippines	June 13, 1968	July 19, 1968	July 18, 1998	TIAS No. 6522, 19 UST 5280
Portugal	May 16, 1974	June 26, 1974	June 25, 2014	TIAS No. 7844, 25 UST 1125
South Africa	July 8, 1957	August 22, 1957	-	TIAS No. 3885, 8 UST 1367
- amendment	June 12, 1962	August 23, 1962	-	TIAS No. 5129, 13 UST 1812
- amendment	July 17, 1967	August 17, 1967	-	TIAS No. 6312, 18 UST 1671
- amendment	May 22, 1974	June 28, 1974	August 21, 2007	TIAS No. 7845, 25 UST 1158
Spain	March 20, 1974	June 28, 1974	June 27, 2014	TIAS No. 7841, 25 UST 1063
Sweden	December 19, 1983	April 11, 1984	April 10, 2014	TIAS No. - , - UST - [5]
Switzerland	December 30, 1965	August 8, 1966	August 7, 1996	TIAS No. 6059, 17 UST 1034
- amendment	November 2, 1973	January 29, 1974	-	TIAS No. 7773, 25 UST 19
Taiwan [6]	April 4, 1972	June 22, 1972	-	TIAS No. 7364, 23 UST 945
- amendment	March 15, 1974	June 14, 1974	June 21, 2014	TIAS No. 7834, 25 UST 913
Thailand	May 14, 1974	June 27, 1974	June 26, 2014	TIAS No. 7850, 25 UST 1181

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[1] The members of EURATOM are Belgium, Denmark, Federal Republic of Germany, France, Greece, Italy, Ireland, Luxembourg, Netherlands, and United Kingdom.

[2] A new agreement with Finland was signed on May 2, 1985. The text of this agreement is available in House Document 99-71, 99th Cong., 1st Sess. (May 21, 1985).

[3] A separate table lists U.S. supply agreements concluded pursuant to the U.S.-IAEA cooperation agreement.

[4] Text of agreement available in House Document 98-164, 98th Cong., 2d Sess. (January 26, 1984).

[5] Text of agreement available in House Document 98-163, 98th Cong., 2d Sess. (January 26, 1984).

[6] On January 1, 1979, the United States recognized the Government of the People's Republic of China as the sole legal Government of China. Within this context, the people of the United States maintain cultural, commercial, and other unofficial relations with the people on Taiwan. The United States acknowledges the Chinese position that there is but one China and Taiwan is a part of China. The United States does not recognize the "Republic of China" as a state or government. Pursuant to Section 6 of the Taiwan Relations Act, P.L. 96-8, 93 Stat. 14, and Executive Order 12143, 44 F.R. 37191, agreements concluded with the Taiwan authorities prior to January 1, 1979, are administered on a nongovernmental basis by the American Institute in Taiwan, a non-profit District of Columbia corporation, and constitute neither recognition of the Taiwan authorities nor the continuation of any official relationship with Taiwan.

[illegible]

May 1985
Office of the Legal Adviser
Department of State

IAEA SUPPLY AGREEMENTS

Agreements between the International Atomic Energy Agency, the United States, and other countries for Supply of Nuclear Material or Equipment pursuant to the Agreement for Peaceful Nuclear Cooperation between the United States and the IAEA.

Agreement	Date Signed	Effective Date	IAEA Information Circular Number	U.S. Citation
Argentina	December 2, 1964	December 2, 1964	62	-
Argentina	December 13, 1964	December 30, 1965	62/Add.1	-
Argentina-Peru	May 9, 1978	May 9, 1978	266	TIAS No. 9263, 30 UST 1539
Brazil	January 12, 1971	January 12, 1971	147, Part II	-
Canada-Jamaica	January 25, 1984	January 25, 1984	315	TIAS No. -, - UST -
Chile	December 19, 1969	December 19, 1969	137	-
Chile	December 31, 1974	December 31, 1974	137/Add. 1	-
Finland	December 30, 1960	December 30, 1960	24	-
Finland	July 8, 1966	July 8, 1966	24/Add.2	-
Finland	November 5, 1967	November 5, 1967	24/Add.3	-
Finland	-	November 27, 1969	24/Add.4	-
Greece	March 1, 1972	March 1, 1972	163	-
Greece	March 1, 1974	March 1, 1974	163/Add.1	-
Greece	December 15, 1977	December 15, 1977	163/Add. 2, Part II	-
India	December 9, 1966	December 9, 1966	94, Part II	-
India	July 2, 1970	July 2, 1970	94/Add. 1, Part I	
India	November 16, 1970	November 16, 1970	94/Add. 1, Part II	-
India	July 1, 1971	July 1, 1971	94/Add. 2, Part I	-
India	August 20, 1971	August 20, 1971	94/Add. 2, Part II	-
India	October 1, 1971	October 1, 1971	94/Add. 2, Part III	-
Indonesia	December 19, 1969	December 19, 1969	136	-
Indonesia	April 7, 1975	April 7, 1975	136/Add.1, Mod. 1	-
Indonesia	September 14, 1972	September 14, 1972	136/Add.1	-
Indonesia	December 7, 1979	December 7, 1979	136/Add.2	TIAS No. 9705, 32 UST 341
Iran	June 7, 1967	June 7, 1967	97	-
Iraq	December 28, 1972	December 28, 1972	195, Part II	-
Malaysia	September 22, 1980	September 22, 1980	287	TIAS No. 9863, - UST -
Malaysia	June 12 and July 22, 1981	July 22, 1981	287/Mod.1	TIAS No. 10202, - UST -
Mexico	December 18, 1963	December 18, 1963	52	TIAS No., 9906, - UST -
Mexico	June 20, 1966	June 20, 1966	82	-

Agreement	Date Signed	Effective Date	IAEA Information Circular Number	U.S. Citation
Mexico	August 23, 1967	August 23, 1967	102	-
Mexico	October 4, 1972	October 4, 1972	52/Add.1	TIAS No. 9906, - UST -
Mexico	December 12, 1972	December 12, 1972	194, Part II	-
Mexico	February 12, 1974	February 12, 1974	203	TIAS No. 10705, - UST -
Mexico	June 14, 1974	June 14, 1974	203/Add.1	TIAS No. 10705, - UST -
Morocco	December 2, 1983	December 2, 1983	313	TIAS No. -, - UST -
Norway	April 10, 1961	June 15, 1961	29	-
Norway	September 3, 1962	September 3, 1962	29/Add.1	-
Norway	April 8, 1964	April 8, 1964	29/Add.2, Part I &II	-
Norway	April 10, 1967	April 10, 1967	29/Add.3	-
Pakistan	March 5, 1962	March 5, 1962	34	-
Pakistan	October 19, 1967	October 19, 1967	34/Add.1	-
Pakistan	June 17, 1968	June 17, 1968	116	-
Pakistan	September 30, 1969	September 30, 1969	34/Add.2	-
Pakistan	June 16, 1971	June 16, 1971	34/Add.3	-
Pakistan	June 22, 1971	June 22, 1971	116/Add.1	-
Pakistan	November 16, 1971	November 16, 1971	150/Add.1	-
Philippines	September 28, 1966	September 28, 1966	88	-
Philippines	August 23, 1968	August 23, 1968	88/Add.1	-
Romania	August 1, 1966	August 1, 1966	95, Part II	-
Romania	March 30, 1973	March 30, 1973	206	-
Romania	September 26, 1973	September 26, 1973	95/Add.2	-
Romania	July 24, 1975	July 24, 1975	206/Mod.1	-
Spain	June 23, 1967	June 23, 1967	99	-
Turkey	February 8, 1966	February 8, 1966	83, Part II	-
Turkey	May 17, 1974	May 17, 1974	212	-
Uruguay	September 24, 1965	September 24, 1965	67	-
Venezuela	November 7, 1975	November 7, 1975	238	-
Yugoslavia	October 4, 1961	October 4, 1961	32	-
Yugoslavia	September 28, 1965	September 28, 1965	32/Add.1	-
Yugoslavia	February 28, 1968	February 28, 1968	32/Add.2	-
Yugoslavia	December 30, 1970	December 30, 1970	32/Add.3	-
Yugoslavia	December 29, 1972	December 29, 1972	32/Add.3/Mod.1	-
Yugoslavia	June 14, 1974	June 14, 1974	213	TIAS No. 9728, - UST -
Yugoslavia	October 31, 1974	October 31, 1974	32/Add.3/Mod.1	-

Agreement	Date Signed	Effective Date	IAEA Information Circular Number	U.S. Citation
Yugoslavia	January 16, 1980	July 14, 1980	32/Add.4	TIAS No. 9767, 32 UST 1228
Yugoslavia	December 14, 15 and 20, 1982	December 20, 1982	32/Add.4/Mod.1	TIAS No. 10621, - UST -
Yugoslavia	February 23, 1983	February 23, 1983	32/Add.5	TIAS No. 10664, - UST -
Zaire	June 27, 1962	June 27, 1962	37, Part II	-
Zaire	February 14, 1969	February 14, 1969	37/Add.2	-
Zaire	December 9, 1970	December 9, 1970	37/Add.3	-
Zaire	April 15, 1971	April 15, 1971	37/Add.4	-

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May 1985
Office of the Legal Adviser
Department of State

(IAEA 1984)

Table 1. Nuclear power plant imports: World Profile*

	[illegible]				Imported from													
	Total		Domestic		USA		Germany, Fed. Rep.		Canada		France		Sweden		UK		USSR	
	[illegible]	MWe	[illegible]	MWe	[illegible]	MWe	[illegible]	MWe	[illegible]	MWe	[illegible]	MWe	[illegible]	MWe	[illegible]	MWe	[illegible]	MWe
Industrialized and European centrally planned countries																		
Belgium	8	5 [illegible]			5	2 [illegible]					3	2670						
Bulgaria	6	3 [illegible]															6	3 [illegible]
Canada	23	14 [illegible]	23	14 [illegible]														
Czechoslovakia	11	[illegible]															11	[illegible]
Finland	4	2 [illegible]											2	1310			2	[illegible]
France	61	[illegible] 100	61	[illegible] 100														
German Dem. Rep.	5	1 [illegible]															5	1 [illegible]
Germany, F.R.	27	20 [illegible]	26	20 [illegible]	1	15												
Hungary	4	1 [illegible]															4	1 [illegible]
Italy	6	3 [illegible]	1	[illegible]	4	3 [illegible]									1	150		
Japan	[illegible]	[illegible]	[illegible]	21 [illegible]	[illegible]	[illegible]									1	[illegible]		
Netherlands	2	[illegible]			1	51	1	[illegible]										
Poland	2	[illegible]															2	[illegible]
Romania	[illegible]	1 [illegible]							[illegible]	[illegible]								
South Africa	2	1 [illegible]									2	[illegible]						
Spain	16	12 [illegible]			13	[illegible]	2	[illegible]			1	[illegible]						
Sweden	12	[illegible]	9	[illegible]	3	2 [illegible]												
Switzerland	5	3 [illegible]			4	1 [illegible]	1	[illegible]										
UK	42	12 [illegible]	42	12 [illegible]														
USA	[illegible]	[illegible]	[illegible]	[illegible]														
USSR	[illegible]	[illegible]	[illegible]	[illegible]														
Yugoslavia	1	[illegible]			1	[illegible]												
Sub-total	[illegible]	[illegible]	410	[illegible]	[illegible]	27 [illegible]	4	[illegible]	2	[illegible]	6	[illegible]	2	1310	2	[illegible]	[illegible]	13 [illegible]
Developing countries																		
Argentina	3	1 [illegible]					2	[illegible]	1	[illegible]								
Brazil	3	1 [illegible]			1	[illegible]	1	[illegible]										
China	1	[illegible]	1	[illegible]														
Cuba	2	[illegible]															2	[illegible]
India	10	2 [illegible]	6	1 [illegible]	2	[illegible]			2	[illegible]								
Korea, Rep. of	9	[illegible]			6	[illegible]			1	[illegible]	2	[illegible]						
Mexico	2	1 [illegible]			2	1 [illegible]												
Pakistan	1	[illegible]							1	[illegible]								
Philippines	1	[illegible]			1	[illegible]												
Taiwan, China	6	4 [illegible]			6	4 [illegible]												
Sub-total	37	[illegible]	7	1 [illegible]	[illegible]	[illegible]	3	[illegible]	5	[illegible]	2	[illegible]					2	[illegible]
World																		
Total	[illegible]	[illegible]	417	[illegible]	[illegible]	[illegible]	7	[illegible]	7	[illegible]	8	[illegible]	2	1310	2	[illegible]	[illegible]	14 [illegible]

* [illegible]

Source: IAEA bulletin, September 1984, p. 32.

(IAEA 1984)

Table 2. Types of nuclear reactor imports*

Type	Reactors on-line or under construction				Imported from													
	Total		Domestic		USA		Germany, Fed. Rep.		Canada		France		Sweden		UK		USSR	
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
PHWR 100-600 MWe	16	4 [illegible]	10	3 [illegible]			1	335	3	509								
PHWR over 600 MWe	18	12 116	13	9 876			1	692	4	2548								
AGR	14	8 132	14	8 132														
GCR 100-600 MWe	26	6 [illegible]	23	5 760							1	480			2	300		
PWR 100-600 MWe	60	28 [illegible]	31	13 405	8	2 786	1	490									20	11 008
PWR over 600 MWe	221	219 707	160	184 521	35	21 864	4	4145			7	6271					2	2 [illegible]
BWR 100-600 MWe	17	7 [illegible]	11	5 420	6	1 836												
BWR over 600 MWe	80	74 041	62	59 445	18	13 877							2	1316				
LWGR over 600 MWe	22	22 [illegible]	22	22 [illegible]														
Prototypes	48	5 [illegible]	44	5 142	3	76											1	62
Total	533	280 [illegible]	417	226 [illegible]	69	40 [illegible]	7	5662	7	3057	8	6751	2	1316	2	300	22	14 [illegible]

* The table includes all reactors connected to the grid or under construction as of 31 December 1983, except those shut down by this date.

Reactor types:

PHWR – Pressurized heavy-water-moderated & cooled
AGR – Advanced gas-cooled, graphite-moderated
GCR – Gas-cooled, graphite-moderated
PWR – Pressurized light-water-moderated & cooled
BWR – Boiling light-water-cooled & moderated
LWGR – Light-water-cooled, graphite-moderated

Source: IAEA bulletin. September 1984, p. 33.

(IAEA 1984)

NUCLEAR POWER PLANT IMPORTS BY REACTOR TYPE, DECEMBER 31, 1983

Reactor Type	Total		Domestic		Imported From													
					USA		Grmny FR		Canada		France		Sweden		UK ¹		USSR	
	No	MW(e)	No	MW(e)	No	MW(e)	No	MW(e)	No	MW(e)	No	MW(e)	No	MW(e)	No	MW(e)	No	MW(e)
PHWR 100-599 MWE	19	6524	15	5650			1	335	3	539								
PHWR >= 600 MWE	18	13116	13	9876			1	691	4	2548								
AGR	14	8132	14	8132														
GCR 100-599 MWE	26	6549	23	5760							1	480			2	309		
PWR 100-599 MWE	68	28208	31	13605	8	2735	1	650									28	11598
PWR >= 600 MWE	221	219797	182	184521	25	21854	4	4345			7	6371					3	2986
BWR 100-599 MWE	17	7356	11	5420	6	1936												
BWR >= 600 MWE	80	76641	62	59448	16	13877							2	1316				
LWGR >= 600 MWE	22	22900	22	22900														
PROTOTYPES	48	5200	44	5162	3	76											1	62
Total	533	392503	417	320254	58	40698	7	5622	7	3087	8	6851	2	1316	2	309	32	14566

Note 1: Includes all reactors connected to the grid or under construction as at 31st December 1983.
Reactors shut down by this date are not included.

Source: IAEA, 1984

EXPORT-IMPORT BANK OF THE UNITED STATES
Authorizations for Nuclear Power Plants and Training Center
Summary by Country
From Inception thru March 31,1984
($ Thousands)

Exhibit A

Country	Export Value			Number of Plants Financed	Eximbank Direct Loans			No. of Loans	Financial Guarantees			No. of Guar.
	Equipment	Fuel	Total		Equipment	Fuel	Total		Equipment	Fuel	Total	
Net Authorizations:												
Argentina	$ -	$ 10,053	$ 10,053	-	$ -	13,466	$ 13,466	1	$ -	$ -	$ -	-
Brazil	263,162	27,572	290,734	1	185,153	17,527	202,680	2	56,996	3,044	60,040	1
France	11,220	5,030	16,250	1	11,220	5,030	16,250	1	-	-	-	-
Germany	27,200	30,940	58,140	1	22,360	30,940	53,300	5	-	-	-	-
Greece	8,295	-	8,295	-	5,775	-	5,775	2	1,275	-	1,275	1
Indonesia	22,734	-	22,734	-	17,060	-	17,060	1	-	-	-	-
Israel	600	-	600	1	465	-	465	2	135	-	135	1
Italy	75,769	26,796	102,565	2	70,851	24,849	95,700	2	-	-	-	-
Japan	634,955	327,806	962,761	11	362,096	135,055	497,151	20	124,988	74,384	199,372	7
Korea	2,216,282	447,756	2,664,038	6	1,621,205	329,900	1,951,105	7	436,273	64,042	500,315	6
Mexico	202,663	37,000	239,663	2	111,520	24,930	136,450	5	53,145	8,370	61,515	3
Philippines	770,000	47,600	817,600	1	255,800	21,400	277,200	1	654,510	21,400	675,910	4
Romania	146,170	515	146,685	-	122,688	219	122,907	2	1,545	219	1,764	1
Spain	1,624,174	358,602	1,982,776	15	831,278	160,292	991,570	18	379,037	75,482	454,519	12
Sweden	44,700	37,935	82,635	2	20,115	20,070	40,185	4	-	6,570	6,570	1
Taiwan	983,142	285,126	1,268,268	6	438,500	156,729	595,229	6	275,925	32,400	308,325	5
Yugoslavia	198,577	22,000	220,577	1	248,986	19,800	268,786	2	29,337	-	29,337	1
Var. European Countries	90,250	-	90,250	-	90,250	-	90,250	1	-	-	-	-
	$7,229,893	$1,673,579	$8,903,472	50	$4,415,817	$959,339	$5,375,156	82	$1,973,166	$276,511	$2,249,677	43

EXPORT-IMPORT BANK OF THE UNITED STATES
Authorizations for Nuclear Power Plants and Training Center
From Inception thru March 31, 1984
($ Thousands)

Exhibit 8

Fiscal Years	No. of Countries	Export Value Equipment	Export Value Fuel	Export Value Total	Number Direct of Loans	Direct Loan Authorizations Equipment	Direct Loan Authorizations Fuel	Direct Loan Authorizations Total	No. of Fin. Guar.	Financial Guarantee Authorizations Equipment	Financial Guarantee Authorizations Fuel	Financial Guarantee Authorizations Total
Gross Authorizations:												
1959	4	122,820	12,530	135,350	4	122,820	12,530	135,350	-	-	-	-
1960	2	26,687	7,310	34,000	1	26,682	7,318	34,000	-	-	-	-
1964	1	2,000	-	2,000	1	2,000	-	2,000	-	-	-	-
1965	1	22,000	5,500	27,500	1	19,000	5,000	24,000	-	-	-	-
1966	1	33,700	10,000	43,700	1	30,030	10,030	40,034	-	-	-	-
1967	4	116,717	56,317	172,034	4	96,560	46,368	143,323	-	-	-	-
1968	2	763	8,750	9,513	2	763	8,750	9,513	-	-	-	-
1969	2	102,029	35,967	138,991	3	87,322	27,974	115,296	-	-	-	-
1970	4	179,830	86,040	265,000	7	127,414	46,351	173,765	-	-	-	-
1971	5	461,410	144,417	605,827	10	211,965	55,235	266,002	3	20,131	9,429	29,560
1972	6	1,005,327	274,019	1,280,346	7	652,087	72,966	725,053	10	193,112	69,027	262,189
1973	6	272,427	57,924	330,351	6	141,083	38,333	179,416	6	224,317	74,971	299,283
1974	6	713,024	60,060	774,083	6	603,411	36,740	639,151	4	138,321	9,133	147,454
1975	7	374,000	109,231	483,231	7	362,079	41,927	404,006	5	147,500	14,940	162,440
1976	6	1,261,502	187,702	1,449,204	6	906,231	41,500	947,731	3	123,371	82,730	206,100
TQ	1	144,000	16,100	160,700	1	73,370	8,000	81,370	5	619,000	52,000	671,003
1977	1	137,000	26,000	163,000	2	75,300	13,300	88,600	1	45,784	5,750	51,534
1978	6	859,305	421,300	1,280,775	6	616,720	200,000	817,714	1	46,958	7,285	54,250
1979	3	395,638	102,900	498,538	1	300,667	105,500	406,067	2	79,000	27,000	106,000
1980	4	687,567	17,203	704,780	1	902,300	6,500	908,800	1	177,225	-	177,225
1981	3	380,700	-	380,712	2	139,743	-	139,743	1	33,904	6,541	40,445
1982	2	38,720	-	38,720	1	24,000	-	24,000	2	114,304	-	114,304
1983	-	70,000	-	70,000	-	-	-	-	-	-	-	-
1st half 1984	-	-	-	-	-	-	-	-	1	284,500	-	284,500
Sub-total		7,266,967	1,673,579	8,934,486	85	4,404,716	981,808	5,386,524	43	2,073,616	299,381	2,372,997
Less supplier part. included in gross auth.		-	-	-		40,413	-	40,413		-	-	-
Less prior FY reversals		11,884	-	11,884 a/		-	-	-		(-180,936)	(-16,250)	(-190,186) c/
Adj. for Portions of Prior FY guar. repurchased		-	-	-		11,514	17,531	29,045 b/e/(1-12)		(-111,514)	(-117,531)	(-129,045) b/e/
Prior FY transfers		-	-	-	(-1) d/	-	-	-	(-1) d/	-	-	-
Net Auth.		$7,255,083	$1,673,579	$8,941,411	85	$4,415,867	$999,339	$5,375,206	41	$1,873,166	$276,711	$2,298,877

a/ Portion of loan #3131 Italy $11,084 thousand originally authorized 3-31-71 --- reduced 1-12-72 per loan agreement, and portion of loan [illegible] - [illegible] 830 thousand authorized [illegible] --- reduced 2-20-76 to reflect proper export value.

b/ FG-3132 and PFG-3209 (Italy) originally authorized 3-31-71 and 6-8-71 respectively --- transferred to loan program on 4-20-73. The participation financing will be treated as a sale rather than a financial guarantee.

c/ Portions of guarantees 3132 and 3209, totalling $16,175 thousand, cancelled after balance transferred to loan program to cover anticipated loan sale portion of guarantee 4005 (Taiwan) of $75,000 thousand, cancelled after being replaced by PEFCO guarantee 4136 approved 9-20-72.

d/ Represents increase originally authorized under credits 4016 and 4052 Mexico --- transferred to credit 4433 and PFG 4434 3-1-77.

e/ A portion of guarantee 4472 (Spain) originally authorized 6-30-73, totalling $3,147 thousand --- transferred to loan program in FY 1980.

123

(DOE 1984)

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                    SUMMARY OF EXPORTS OF ENRICHED URANIUM, PLUTONIUM, AND DEUTERIUM
                                        *** UNCLASSIFIED ***
ANNUAL REPORT TJ-29           01-01-83 THRU 06-30-84        RUN DATE: 09/27/84        TIME: 190833        PAGE    1
      SUMMARY LINES
COUNTRY-TO         MATERIAL-TYPE        YEAR                MATERIAL          UNIT        ELEMENT            ISOTOPE
BELGIUM            20                   83                  20 ENRICHED U.    GMS        27,749.00           1,358.00
BELGIUM            20                   84                  20 ENRICHED U.    GMS         1,294.00             370.00
BELGIUM            50                   83                  50 PLUTONIUM      GMS           123.00              97.00
CANADA             20                   83                  20 ENRICHED U.    GMS       843,158.00         154,161.00
CANADA             20                   84                  20 ENRICHED U.    GMS       190,755.00          58,846.00
TAIWAN             20                   82                  20 ENRICHED U.    GMS                             15,694.00
TAIWAN             20                   83                  20 ENRICHED U.    GMS   250,358,119.00       7,358,448.00
TAIWAN             20                   84                  20 ENRICHED U.    GMS    35,140,444.00       1,187,057.00
TAIWAN             60                   83                  60 DEUTERIUM      KGS         1,000.20             801.00
CZECHOSLOVAKIA     20                   83                  20 ENRICHED U.    GMS           858.00              52.00
CZECHOSLOVAKIA     20                   84                  20 ENRICHED U.    GMS           246.00              16.00
CZECHOSLOVAKIA     50                   83                  50 PLUTONIUM      GMS            27.00              23.00
DENMARK            20                   83                  20 ENRICHED U.    GMS        13,942.00             175.00
DENMARK            20                   84                  20 ENRICHED U.    GMS           299.00               9.00
DENMARK            50                   83                  50 PLUTONIUM      GMS           106.00              82.00
EURATOM            20                   83                  20 ENRICHED U.    GMS        16,568.00          10,355.00
FINLAND            20                   83                  20 ENRICHED U.    GMS           472.00              22.00
FINLAND            20                   84                  20 ENRICHED U.    GMS           468.00              20.00
FRANCE             20                   83                  20 ENRICHED U.    GMS       146,749.00          35,904.00
FRANCE             20                   84                  20 ENRICHED U.    GMS       374,342.00          24,880.00
FRANCE             50                   83                  50 PLUTONIUM      GMS             6.00               6.00
GERMANY(WEST)      20                   83                  20 ENRICHED U.    GMS   936,491,716.00      17,638,931.00
GERMANY(WEST)      20                   84                  20 ENRICHED U.    GMS   294,185,525.00       9,033,029.00
GERMANY(WEST)      50                   83                  50 PLUTONIUM      GMS                0                  0
GERMANY(WEST)      50                   84                  50 PLUTONIUM      GMS            10.00              10.00
EGYPT              50                   84                  50 PLUTONIUM      GMS                0                  0
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484

460

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                                         *** UNCLASSIFIED ***
NMMSS REPORT TJ-25            01-01-83 THRU 06-30-84        RUN DATE: 09/27/84        TIME: 190833        PAGE    2
     SUMMARY LINES
COUNTRY-ID              MATERIAL-TYPE        YEAR                   MATERIAL           UNIT        ELEMENT              ISOTOPE
IAEA                    20                   83                     20 ENRICHED U.     GMS        1,423.00                43.00
IAEA                    20                   84                     20 ENRICHED U.     GMS          500.00                45.00
INDONESIA               20                   83                     20 ENRICHED U.     GMS       22,149.00             4,032.00
INDONESIA               20                   84                     20 ENRICHED U.     GMS        6,473.00             1,279.00
INDONESIA               50                   83                     50 PLUTONIUM       GMS               0                    0
ITALY                   20                   83                     20 ENRICHED U.     GMS   12,504,908.00           333,016.00
ITALY                   20                   84                     20 ENRICHED U.     GMS      264,799.00             8,917.00
ITALY                   50                   83                     50 PLUTONIUM       GMS          176.00               141.00
JAPAN                   20                   83                     20 ENRICHED U.     GMS  203,046,331.00        20,963,160.00
JAPAN                   20                   84                     20 ENRICHED U.     GMS  138,213,723.00        10,185,710.00
JAPAN                   50                   83                     50 PLUTONIUM       GMS    2,049,077.00         2,136,913.00
JAPAN                   50                   84                     50 PLUTONIUM       GMS      831,969.00           665,884.00
SOUTH KOREA, REPUBLIC   20                   83                     20 ENRICHED U.     GMS   18,373,750.00           995,128.00
SOUTH KOREA, REPUBLIC   20                   84                     20 ENRICHED U.     GMS   98,941,797.00         2,327,292.00
MEXICO                  20                   83                     20 ENRICHED U.     GMS                             9,969.70
MEXICO                  20                   84                     20 ENRICHED U.     GMS            2.00                 2.00
NETHERLANDS             20                   83                     20 ENRICHED U.     GMS       91,743.00             1,735.00
NETHERLANDS             20                   84                     20 ENRICHED U.     GMS       79,333.00             3,162.00
NORWAY                  20                   83                     20 ENRICHED U.     GMS       23,334.00               395.00
NORWAY                  50                   83                     50 PLUTONIUM       GMS          130.00               109.00
PERU                    20                   84                     20 ENRICHED U.     GMS            0.00                    0
PHILIPPINES             20                   83                     20 ENRICHED U.     GMS       84,305.00            16,639.00
PHILIPPINES             20                   84                     20 ENRICHED U.     GMS       26,021.00             3,299.00
SWITZERLAND             20                   83                     20 ENRICHED U.     GMS  126,335,918.00         2,039,063.00
SWITZERLAND             20                   84                     20 ENRICHED U.     GMS   25,499,392.00           631,273.00
SWITZERLAND             50                   83                     50 PLUTONIUM       GMS      690,893.00           523,916.00

SWITZERLAND             50                   84                     50 PLUTONIUM       GMS      853,871.00           685,616.00
                                         *** UNCLASSIFIED ***
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                                             *** UNCLASSIFIED ***
NMMSS REPORT TJ-25                01-01-83 THRU 06-30-84        RUN DATE: 09/27/84          TIME: 190633          PAGE     3
      SUMMARY LINES
COUNTRY-ID            MATERIAL-TYPE          YEAR                         MATERIAL          UNIT        ELEMENT                ISOTOPE
SPAIN                 20                     83                           20 ENRICHED U.    GMS   122,624,030.00           3,066,967.00
SPAIN                 20                     84                           20 ENRICHED U.    GMS    56,333,464.00           1,940,628.00
SWEDEN                20                     83                           20 ENRICHED U.    GMS   299,424,044.00          11,090,051.00
SWEDEN                20                     84                           20 ENRICHED U.    GMS        29,392.00               3,272.00
SWEDEN                50                     83                           50 PLUTONIUM      GMS       427,267.00             263,400.00
SWEDEN                50                     84                           50 PLUTONIUM      GMS           196.00                 136.00
UNITED KINGDOM        20                     83                           20 ENRICHED U.    GMS        10,612.00                 493.00
UNITED KINGDOM        20                     84                           20 ENRICHED U.    GMS    15,051,215.00             241,912.00
UNITED KINGDOM        50                     83                           50 PLUTONIUM      GMS                0                      0
UNITED KINGDOM        50                     84                           50 PLUTONIUM      GMS           231.00                 168.00
YUGOSLAVIA            20                     83                           20 ENRICHED U.    GMS    17,563,961.00             376,762.00
YUGOSLAVIA            20                     84                           20 ENRICHED U.    GMS    15,385,035.00             580,239.00
                                             *** UNCLASSIFIED ***

                       **NOTES**

The figures in this report represent initial exports to foreign countries.  It
should be noted that additional information on activities such as returns,
retransfers, use, production, operating losses, and waste production occurring
subsequent to these initial exports would be necessary to produce current
inventories.  In general, foreign countries are only required to report returns
and retransfers.

The total shipment weight of uranium and plutonium are represented in the
element column, while the weight of the fissionable part is represented in
the isotope column.  Shipments of heavy water are reported under the element
column of the material deuterium.  The weight of the deuterium is in the
isotope column.

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Source: U. S. Department of Energy, Office of Safeguards and Security, October 9, 1984

(GAO 1983)

Dual-Use, Nuclear-Related Items Licensed By Commerce July 1, 1981 to June 30, 1982 (note a)

Item	Licenses Issued Number	Licenses Issued Percent	Amount (millions)
Electronic computers and related equipment	5,842	57.1	$1,258.8
Measuring and calibrating test equipment	1,602	15.7	70.9
Lasers and laser systems	621	6.1	55.0
Communication/detection/tracking equipment	323	3.2	10.1
Oscilloscopes	232	2.3	2.5
Filamentary materials	187	1.8	23.3
Electric/electronic equipment	167	1.6	1.8
Boron metal compounds	155	1.5	2.3
Image processers	112	1.1	25.5
Photographic equipment (specified)	104	1.0	.9
Zirconium alloys	102	1.0	8.2
Photographic equipment--high-speed cameras	94	0.9	.7
Triggered spark gaps (specified)	90	0.9	.4
Lithium compounds	84	0.8	4.4
Numerical control equipment	77	0.8	14.1
Photomultiplier tubes	48	0.5	.2
Inverters	38	0.4	.9
Cryogenic equipment/materials	38	0.4	.4
Beryllium compounds	34	0.3	4.0
Hafnium compounds	34	0.3	1.4
Hydrogen thyratrons	33	0.3	.2
Vibration test equipment	30	0.3	1.5
Total	10,047	98.3	$1,487.5

[a] Developed by GAO from data in Commerce's computerized information system.

Source: Controlling Exports of Dual-Use Nuclear-Related Equipment. U.S. General Accounting Office. GAO/NSIAD-83-28. September 29,1983.

(GAO 1983)

36 Top Buyers of Dual-Use, Nuclear-Related Equipment
July 1, 1981 to June 30, 1982

Country	Licenses issued Number	Licenses issued Percent	Amount (millions)
People's Republic of China (note a)	1,080	10.56	$ 103.3
India (note a)	776	7.59	64.3
South Africa (note a)	619	6.06	164.1
Israel (note a)	619	6.05	102.3
Taiwan	537	5.25	69.3
Japan	507	4.96	25.0
Argentina (note a)	496	4.85	66.1
Czechoslovakia	406	3.97	29.6
Brazil (note a)	392	3.84	111.1
Spain (note a)	351	3.43	63.1
Federal Republic of Germany	343	3.36	21.5
France (note a)	339	3.32	54.3
United Kingdom	325	3.18	22.9
Saudi Arabia (note a)	288	2.82	179.3
Hungary	227	2.22	24.0
Chile (note a)	221	2.16	49.3
Italy	125	1.22	8.9
Soviet Union	116	1.14	0.6
Switzerland	107	1.05	1.7
Romania	106	1.03	21.0
Bulgaria	104	1.02	0.3
Iraq	102	1.00	31.0
Australia	100	0.98	6.0
Kuwait (note b)	92	0.90	52.5
Netherlands	91	0.89	4.0
Egypt	86	0.84	9.4
Pakistan (note a)	82	0.80	12.3
United Arab Emirates (note a)	81	0.79	34.0
German Democratic Republic	78	0.76	5.1
Poland	72	0.70	7.7
Yugoslavia	69	0.68	2.4
Sweden	66	0.65	3.5
Republic of Korea	57	0.56	11.1
Oman (note a)	52	0.51	6.3
Mexico	52	0.51	2.7
Libya	48	0.47	6.4
Total	9,211	90.1	$1,394.8

[a] Not a party to Nuclear Non-Proliferation Treaty as of Dec. 1982.
[b] Has signed, but has not ratified the Nuclear Non-Proliferation Treaty.

Source: Controlling Exports of Dual-Use Nuclear-Related Equipment. U.S. General Accounting Office. GAO/NSIAD-83-28. September 29,1983.

NUCLEAR EXPORT POLICIES OF MAJOR SUPPLIER COUNTRIES (c. 1980)

	Canada	USA	France	West Germany	USSR
Nuclear Suppliers Group Guidelines	*	*	*	*	*
NPT Membership or equivalent binding assurance	*	*	*	*	*
Safeguards for exports	*	*	*	*	*
Full-scope safeguards	*	*			
Fall-back safeguards	*	*			
Denial of enrichment technology	n.a.	*	**	**	*
Denial of reprocessing technology	n.a.	*	*	*	*
Prior consent for enrichment >20 per cent or reprocessing required	*	*			
Return of all spent fuel to supplier country					***

Notes
- * Announced policy
- ** Informal commitment as member of the Nuclear Suppliers Group.
- *** At least in relation to Comecon countries.

Source: William Walker and Mans Lonnroth, Nuclear Power Struggles. George Allen and Unwin, 1983, p. 147.

NUCLEAR EXPORTS SUBJECT TO GOVERNMENT CONTROL

Item	Control	Agency	Federal Regulation
Goods			
Special nuclear material 2/	Export license required	NRC	10 CFR 110 1/
Source material 3/	Export license required	NRC	10 CFR 110 1/
Byproduct materials 4/	Export license required	NRC	10 CFR 110 1/
Major plant and equipment 5/	Export license required	NRC	10 CFR 110 1/
Components, materials and substances 6/	Export license required	NRC	10 CFR 110 1/
Dual use components		DOC, DOE	15 CFR 399
Technical services and technology transfer	Authorization required	DOE	10 CFR 810
Information			
Classified restricted data	Export barred		
Sensitive nuclear technology 7/	Authorization required	DOE	10 CFR 810
Unclassified scientific and technical information	General authority	No action required	
Retransfer of certain export items 8/	Authorization required	DOE 10 CRF 810	

1/ Exports to non-nuclear weapons states restricted to those accepting full scope safeguards of the International Atomic Energy Agency.

2/ Special nuclear materials are mainly enriched uranium and plutonium.

3/ Source material is natural uranium.

4/ Byproduct materials are radioisotopes produced in a nuclear reactor.

5/ Reactors and major parts of reactors such as pressure vessels; parts are specified in APP to 10 CFR 110.

6/ Exports licensed under sec. 109 (b) of the Atomic Energy Act of 1954 as amended. Note, this section permits exports to countries not under full scope safeguards as long as the item is under safeguards.

7/ Sensitive nuclear technologies are those which are not available to the public and are important to the design, fabrication operation or maintenance of a uranium enrichment or fuel reprocessing facility or a facility for the production of heavy water.

8/ Mainly used, or "spent" nuclear fuel, and plutonium recovered from it.

Source: Congressional Research Service.

INF

International Atomic Energy Agency
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INFCIRC/209
3 September 1974

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COMMUNICATIONS RECEIVED FROM MEMBERS REGARDING THE EXPORT OF NUCLEAR MATERIAL AND OF CERTAIN CATEGORIES OF EQUIPMENT AND OTHER MATERIAL

1. On 22 August 1974 the Director General received letters, all dated that day, from the Resident Representatives to the Agency of Australia, Denmark, Canada, Finland, Norway, the Union of Soviet Socialist Republics, the United Kingdom of Great Britain and Northern Ireland and the United States of America, relating to the commitments of these eight Members under Article III, paragraph 2 of the Treaty on the Non-Proliferation of Nuclear Weapons[1]. In the light of the wish expressed at the end of each of these letters, their text is reproduced below as Letter I.

2. On the same day, the Resident Representatives of Denmark and of the United Kingdom also addressed complementary letters to the Director General, the text of which is reproduced below as Letter II. On that day also the Resident Representative of the United States sent a complementary letter, the text of which is reproduced as Letter III.

3. Also on 22 August, the Resident Representatives of the Federal Republic of Germany and of the Netherlands each addressed to the Director General a letter analogous to the above-mentioned Letters I and II, the text of which is reproduced below as Letter IV.

4. The attachments to the Letters I and IV, which consist in both cases of the same memoranda, are reproduced in the Appendix.

Letter I

> I have the honour to inform you that the Government of .... has had under consideration procedures in relation to exports of (a) source or special fissionable material, and (b) equipment and material especially designed or prepared for the processing, use or production of special fissionable material, in the light of its commitment under Article III paragraph 2 of the Treaty on the Non-Proliferation of Nuclear Weapons not to provide such

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[1] Reproduced in document INFCIRC/140.

items to any non-nuclear-weapon State for peaceful purposes, unless the source or special fissionable material is subject to safeguards under an agreement with the International Atomic Energy Agency.

The Government of ..... has decided to act in this context in accordance with the attached memoranda.

I shall be grateful if you will bring this information to the attention of all Members of the Agency.

Letter II

I have the honour to refer to my letter of today's date, and to inform you that, so far as trade within the European Community is concerned, the Government of ..... will, where necessary, implement paragraphs 5 of the memoranda enclosed with that letter in the light of its commitments under the Treaties of Rome.

Letter III

With reference to my letter of this date, concerning procedures of the Government of the United States of America in relation to exports of source and special fissionable material and of equipment and material especially designed or prepared for the processing, use or production of special fissionable material, I shall provide you shortly with additional information concerning the implementation by my Government of such procedures.

I would like to call attention to paragraph 6 of Memorandum B, enclosed with my letter, and to note that, in accordance with existing procedures of my Government, safeguards are required in relation to items of equipment and material exported from the United States of America, in addition to those specified in paragraph 3 of that Memorandum.

I shall be grateful if you will bring this information to the attention of all Members of the Agency.

Letter IV

I have the honour to inform you that the Government of ..... has had under consideration procedures in relation to exports to any non-nuclear-weapon State for peaceful purposes of (a) source or special fissionable material, and (b) certain categories of equipment and material especially designed or prepared for the processing, use or production of special fissionable material.

The Government of ..... has decided to act in this context in accordance with the attached memoranda. So far as trade within the European Community is concerned, the Government of ..... will, where necessary, implement paragraphs 5 of the memoranda in the light of its commitments under the Treaties of Rome.

I shall be grateful if you will bring this information to the attention of all Members of the Agency.

APPENDIX

MEMORANDUM A

INTRODUCTION

1. The Government has had under consideration procedures in relation to exports of nuclear materials in the light of its commitment not to provide source or special fissionable material to any non-nuclear-weapon State for peaceful purposes unless the source or special fissionable material is subject to safeguards under an agreement with the International Atomic Energy Agency.

DEFINITION OF SOURCE AND SPECIAL FISSIONABLE MATERIAL

2. The definition of source and special fissionable material adopted by the Government shall be that contained in Article XX of the Agency's Statute.[1]

THE APPLICATION OF SAFEGUARDS

3. The Government is solely concerned with ensuring, where relevant, the application of safeguards in non-nuclear-weapon States not party to the Treaty on the Non-Proliferation of Nuclear Weapons (NPT)[2] with a view to preventing diversion of the safeguarded nuclear material from peaceful purposes to nuclear weapons or other nuclear explosive devices. If the Government wishes to supply source or special fissionable material for peaceful purposes to such a State, it will:

(a) Specify to the recipient State, as a condition of supply, that the source or special fissionable material, or special fissionable material produced in or by the use thereof, shall not be diverted to nuclear weapons or other nuclear explosive devices; and

(b) Satisfy itself that safeguards to that end, under an agreement with the Agency and in accordance with its safeguards system, will be applied to the source or special fissionable material in question.

DIRECT EXPORTS

4. In the case of direct exports of source or special fissionable material to non-nuclear-weapon States not party to NPT, the Government will satisfy itself, before authorizing the export of the material in question, that such material will be subject to a safeguards agreement with the Agency, as soon as the recipient State takes over responsibility for the material, but no later than the time the material reaches its destination.

RETRANSFERS

5. The Government, when exporting source or special fissionable material to a nuclear-weapon State not party to NPT, will require satisfactory assurances that the material will not be re-exported to a non-nuclear-weapon State not party to NPT unless arrangements corresponding to those referred to above are made for the acceptance of safeguards by the State receiving such re-export.

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[1] See also para. 6 below.

[2] Reproduced in document INFCIRC/140.

MISCELLANEOUS

6. Exports of the items specified in sub-paragraph (a) below, and exports of source or special fissionable material to a given recipient country, within a period of 12 months, below the limits specified in sub-paragraph (b) below, shall be disregarded for the purpose of the procedures described above:

(a) Plutonium with an isotopic concentration of plutonium-238 exceeding 80%;

Special fissionable material when used in gram quantities or less as a sensing component in instruments; and

Source material which the Government is satisfied is to be used only in non-nuclear activities, such as the production of alloys or ceramics;

(b)

Special fissionable material	50 effective grams;
Natural uranium	500 kilograms;
Depleted uranium	1000 kilograms; and
Thorium	1000 kilograms.

MEMORANDUM B

INTRODUCTION

1. The Government has had under consideration procedures in relation to exports of certain categories of equipment and material, in the light of its commitment not to provide equipment or material especially designed or prepared for the processing, use or production of special fissionable material to any non-nuclear-weapon State for peaceful purposes, unless the source or special fissionable material produced, processed or used in the equipment or material in question is subject to safeguards under an agreement with the International Atomic Energy Agency.

THE DESIGNATION OF EQUIPMENT OR MATERIAL ESPECIALLY DESIGNED OR PREPARED FOR THE PROCESSING, USE OR PRODUCTION OF SPECIAL FISSIONABLE MATERIAL

2. The designation of items of equipment or material especially designed or prepared for the processing, use or production of special fissionable material (hereinafter referred to as the "Trigger List") adopted by the Government is as follows (quantities below the indicated levels being regarded as insignificant for practical purposes):

2.1. Reactors and equipment therefor:

2.1.1. Nuclear reactors capable of operation so as to maintain a controlled self-sustaining fission chain reaction, excluding zero energy reactors, the latter being defined as reactors with a designed maximum rate of production of plutonium not exceeding 100 grams per year.

2.1.2. Reactor pressure vessels:

Metal vessels, as complete units or as major shop-fabricated parts therefor, which are especially designed or prepared to contain the core of a nuclear reactor as defined in paragraph 2.1.1 above and are capable of withstanding the operating pressure of the primary coolant.

2.1.3. Reactor fuel charging and discharging machines:

Manipulative equipment especially designed or prepared for inserting or removing fuel in a nuclear reactor as defined in paragraph 2.1.1 above capable of on-load operation or employing technically sophisticated positioning or alignment features to allow complex off-load fuelling operations such as those in which direct viewing of or access to the fuel is not normally available.

2.1.4. Reactor control rods:

Rods especially designed or prepared for the control of the reaction rate in a nuclear reactor as defined in paragraph 2.1.1 above.

2.1.5. Reactor pressure tubes:

Tubes which are especially designed or prepared to contain fuel elements and the primary coolant in a reactor as defined in paragraph 2.1.1 above at an operating pressure in excess of 50 atmospheres.

2.1.6. Zirconium tubes:

Zirconium metal and alloys in the form of tubes or assemblies of tubes, and in quantities exceeding 500 kg, especially designed or prepared for use in a reactor as defined in paragraph 2.1.1 above, and in which the relationship of hafnium to zirconium is less than 1:500 parts by weight.

2.1.7. Primary coolant pumps:

Pumps especially designed or prepared for circulating liquid metal as primary coolant for nuclear reactors as defined in paragraph 2.1.1 above.

2.2. Non-nuclear materials for reactors:

2.2.1. Deuterium and heavy water:

Deuterium and any deuterium compound in which the ratio of deuterium to hydrogen exceeds 1:5000 for use in a nuclear reactor as defined in paragraph 2.1.1 above in quantities exceeding 200 kg of deuterium atoms for any one recipient country in any period of 12 months.

2.2.2. Nuclear grade graphite:

Graphite having a purity level better than 5 parts per million boron equivalent and with a density greater than 1.50 grams per cubic centimetre in quantities exceeding 30 metric tons for any one recipient country in any period of 12 months.

2.3.1. Plants for the reprocessing of irradiated fuel elements, and equipment especially designed or prepared therefor.

2.4.1. Plants for the fabrication of fuel elements.

2.5.1. Equipment, other than analytical instruments, especially designed or prepared for the separation of isotopes of uranium.

Clarifications of certain of the Items on the above list are annexed.

THE APPLICATION OF SAFEGUARDS

3. The Government is solely concerned with ensuring, where relevant, the application of safeguards in non-nuclear-weapon States not party to the Treaty on the Non-Proliferation of Nuclear Weapons (NPT)[1] with a view to preventing diversion of the safeguarded nuclear material from peaceful purposes to nuclear weapons or other nuclear explosive devices. If the Government wishes to supply Trigger List Items for peaceful purposes to such a State, it will:

(a) Specify to the recipient State, as a condition of supply, that the source or special fissionable material produced, processed or used in the facility for which the item is supplied shall not be diverted to nuclear weapons or other nuclear explosive devices; and

(b) Satisfy itself that safeguards to that end, under an agreement with the Agency and in accordance with its safeguards system, will be applied to the source or special fissionable material in question.

DIRECT EXPORTS

4. In the case of direct exports to non-nuclear-weapon States not party to NPT, the Government will satisfy itself, before authorizing the export of the equipment or material in question, that such equipment or material will fall under a safeguards agreement with the Agency.

RETRANSFERS

5. The Government, when exporting Trigger List Items, will require satisfactory assurances that the Items will not be re-exported to a non-nuclear-weapon State not party to NPT unless arrangements corresponding to those referred to above are made for the acceptance of safeguards by the State receiving such re-export.

MISCELLANEOUS

6. The Government reserves to itself discretion as to interpretation and implementation of its commitment referred to in paragraph 1 above and the right to require, if it wishes, safeguards as above in relation to Items it exports in addition to those Items specified in paragraph 2 above.

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[1] Reproduced in document INFCIRC/140.

Note: Subsequently Austria, Czechoslovakia, The German Democratic Republic, Hungary, Ireland, Japan, Poland, and Sweden sent similar letters to the Director General.

ANNEX

CLARIFICATIONS OF ITEMS ON THE TRIGGER LIST

A. Complete nuclear reactors

(Item 2.1.1 of the Trigger List)

1. A "nuclear reactor" basically includes the items within or attached directly to the reactor vessel, the equipment which controls the level of power in the core, and the components which normally contain or come in direct contact with or control the primary coolant of the reactor core.

2. The export of the whole set of major items within this boundary will take place only in accordance with the procedures of the memorandum. Those individual items within this functionally defined boundary which will be exported only in accordance with the procedures of the memorandum are listed in paragraphs 2.1.1 to 2.1.5. Pursuant to paragraph 6 of the memorandum, the Government reserves to itself the right to apply the procedures of the memorandum to other items within the functionally defined boundary.

3. It is not intended to exclude reactors which could reasonably be capable of modification to produce significantly more than 100 grams of plutonium per year. Reactors designed for sustained operation at significant power levels, regardless of their capacity for plutonium production, are not considered as "zero energy reactors".

B. Pressure vessels

(Item 2.1.2 of the Trigger List)

4. A top plate for a reactor pressure vessel is covered by item 2.1.2 as a major shop-fabricated part of a pressure vessel.

5. Reactor internals (e.g. support columns and plates for the core and other vessel internals, control rod guide tubes, thermal shields, baffles, core grid plates, diffuser plates, etc.) are normally supplied by the reactor supplier. In some cases, certain internal support components are included in the fabrication of the pressure vessel. These items are sufficiently critical to the safety and reliability of the operation of the reactor (and, therefore, to the guarantees and liability of the reactor supplier), so that their supply, outside the basic supply arrangement for the reactor itself, would not be common practice. Therefore, although the separate supply of these unique, especially designed and prepared, critical, large and expensive items would not necessarily be considered as falling outside the area of concern, such a mode of supply is considered unlikely.

C. Reactor control rods

(Item 2.1.4 of the Trigger List)

6. This item includes, in addition to the neutron absorbing part, the support or suspension structures therefor if supplied separately.

D. Fuel reprocessing plants

(Item 2.3.1 of the Trigger List)

7. A "plant for the reprocessing of irradiated fuel elements" includes the equipment and components which normally come in direct contact with and directly control the irradiated fuel and the major nuclear material and fission product processing streams. The export of the whole set of major items within this boundary will take place only in accordance with the

procedures of the memorandum. In the present state of technology only two items of equipment are considered to fall within the meaning of the phrase "and equipment especially designed or prepared therefor". These items are:

(a) Irradiated fuel element chopping machines: remotely operated equipment especially designed or prepared for use in a reprocessing plant as identified above and intended to cut, chop or shear irradiated nuclear fuel assemblies, bundles or rods; and

(b) Critically safe tanks (e. g. small diameter, annular or slab tanks) especially designed or prepared for use in a reprocessing plant as identified above, intended for dissolution of irradiated nuclear fuel and which are capable of withstanding hot, highly corrosive liquid, and which can be remotely loaded and maintained.

8. Pursuant to paragraph 6 of the memorandum, the Government reserves to itself the right to apply the procedures of the memorandum to other items within the functionally defined boundary.

E. Fuel fabrication plants

(Item 2.4.1 of the Trigger List)

9. A "plant for the fabrication of fuel elements" includes the equipment:

(a) Which normally comes in direct contact with, or directly processes, or controls, the production flow of nuclear material, or

(b) Which seals the nuclear material within the cladding.

10. The export of the whole set of items for the foregoing operations will take place only in accordance with the procedures of the memorandum. The Government will also give consideration to application of the procedures of the memorandum to individual items intended for any of the foregoing operations, as well as for other fuel fabrication operations, such as checking the integrity of the cladding or the seal, and the finish treatment to the solid fuel.

F. Isotope separation plant equipment

(Item 2.5.1 of the Trigger List)

11. "Equipment, other than analytical instruments, especially designed or prepared for the separation of isotopes of uranium" includes each of the major items of equipment especially designed or prepared for the separation process.

IAEA

PR 78/2
FOR IMMEDIATE RELEASE

INTERNATIONAL ATOMIC ENERGY AGENCY [illegible] VIENNA, AUSTRIA
[illegible] VIENNA

PRESS RELEASE

FOR USE OF INFORMATION MEDIA - NOT AN OFFICIAL RECORD

ANNOUNCEMENT OF IDENTICAL POLICIES ON NUCLEAR EXPORTS: COMMUNICATIONS BY 15 MEMBER GOVERNMENTS OF THE IAEA

Vienna, 16 January 1978: The Director General of the International Atomic Energy Agency (IAEA) has received letters from Belgium, Canada, Czechoslovakia, France, German Democratic Republic, Germany, Federal Republic of, Italy, Japan, the Netherlands, Poland, Sweden, Switzerland, United Kingdom, USA and USSR concerning their common policy with regard to the export of nuclear material, equipment and technology. The communications set forth principles and detailed guidelines which these governments will follow when considering nuclear exports. These identical policies are based on a common "Trigger List" of nuclear and other materials, equipment and facilities which will be exported if certain specified conditions are met.

These conditions include:

- a formal assurance from the recipient government explicitly excluding uses which would result in any nuclear explosive device;
- effective physical protection by the importing country to prevent any unauthorized use and handling of the material or facilities;
- the application of IAEA safeguards to the exported item with duration and coverage provisions which conform to guidelines established by the IAEA Board of Governors.

All these requirements will also apply to facilities for reprocessing of nuclear fuel, enrichment of uranium or production of heavy water, which utilize technology that has been directly transferred by the supplier or that is derived from transferred facilities or major critical components thereof. The guidelines also call for restraint in the transfer of sensitive facilities, technology and weapons-usable material, as well as encouragement of alternatives to national enrichment or reprocessing plants, such as multi-national fuel cycle centres. Supplied enrichment facilities are not to be used to produce uranium enriched above a level of 20%, unless the supplier nation consents; supplier nation consent will also be required for reprocessing i.e. separation of plutonium from the supplied nuclear material after its burn up in the reactor as well as for the re-transfer of "Trigger List" items, such transfers will only take place on conditions essentially identical to the original transfer.

In its communication each supplying country stated that it will make special efforts in support of the effective implementation of IAEA safeguards, including measures to improve national systems of accounting and control, and to increase the technical efficacy of safeguards and to promote the design of sensitive plant in such a way as to facilitate safeguards application.

./.

Each of the Governments concerned states that it has decided on its policies in full awareness of the need to contribute to the development of nuclear energy in order to meet world energy requirements, while avoiding contributing in any way to the dangers of nuclear proliferation and also in full awareness of the need to remove safeguards and non-proliferation assurances from the field of commercial competition. Each Government hopes that other Governments will decide to follow similar nuclear export policies.

In their communication, the Governments of the German Democratic Republic, Poland and the Soviet Union additionally support the principle that "Trigger List" items should only be exported if all nuclear activities in the recipient non-nuclear-weapon country are under IAEA safeguards (and not only the exported item itself). The Governments of Belgium, Japan and Switzerland have stated in their communication that they are not currently able to follow the implementation of the guidelines on technology transfer, because of the absence at present of implementing national legislation or regulations. The Government of Canada has stated in its communication that it may apply additional control and safeguards requirements.

At the request of the Governments concerned, the Director General of the IAEA is circulating the text of the guidelines to all Member States of the Agency for their information and "as a demonstration of support (by the Governments concerned) for the Agency's non-proliferation objectives and safeguards activities".

.....

.NUCLEAR SUPPLIERS GUIDELINES

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International Atomic Energy Agency

INFORMATION CIRCULAR

COMMUNICATIONS RECEIVED FROM CERTAIN MEMBER STATES REGARDING GUIDELINES FOR THE EXPORT OF NUCLEAR MATERIAL, EQUIPMENT OR TECHNOLOGY

1. On 11 January 1978, the Director General received similar letters, all of that date, from the Resident Representatives to the Agency of Czechoslovakia, France, the German Democratic Republic, Japan, Poland, Switzerland, the Union of Soviet Socialist Republics and the United States of America, relating to the export of nuclear material, equipment or technology. In the light of the request at the end of each of those letters, the text is reproduced below as Letter I.

2. On the same day, the Resident Representatives to the Agency of Canada and Sweden also addressed analogous letters to the Director General. In the light of the request expressed at the end of each of those letters, their texts are reproduced below as Letter II and Letter III respectively.

3. On the same day, the Director General received similar letters from the Resident Representatives to the Agency of Belgium, the Federal Republic of Germany, the Netherlands and the United Kingdom of Great Britain and Northern Ireland, Members of the European Communities, relating to the export of nuclear material, equipment or technology. In the light of the request expressed at the end of each of those letters, the text is reproduced below as Letter IV.

4. On 11 January 1978 the Resident Representative to the Agency of Italy, a Member of the European Communities, addressed a letter to the Director General relating to the same subject, the text of which is reproduced below as Letter V.

5. On 11 January 1978 the Director General received complementary letters, all of that date, from the Resident Representatives to the Agency of Belgium, Czechoslovakia, the German Democratic Republic, Japan, Poland, Switzerland and the Union of Soviet Socialist Republics, the texts of which are reproduced below as Letters VI, VII, VIII, IX, X, XI and XII respectively.

6. The attachments to Letters I-V, which are in every case identical, setting forth the Guidelines for Nuclear Transfers with their Annexes, are reproduced in the Appendix.

LETTER I

The Permanent Mission of .... presents its compliments to the Director General of the International Atomic Energy Agency and has the honour to enclose copies of three documents which have been the subject of discussion between the Government of .... and a number of other Governments.

The Government of .... has decided that, when considering the export of nuclear material, equipment or technology, it will act in accordance with the principles contained in the attached documents.

In reaching this decision, the Government of .... is fully aware of the need to contribute to the development of nuclear power in order to meet world energy requirements, while avoiding contributing in any way to the dangers of a proliferation of nuclear weapons or other nuclear explosive devices, and of the need to remove safeguards and non-proliferation assurances from the field of commercial competition.

The Government of .... hopes that other Governments may also decide to base their own nuclear export policies upon these documents.

The Government of .... requests that the Director General of the International Atomic Energy Agency should circulate the texts of this note and its enclosures to all Member Governments for their information and as a demonstration of support by the Government of .... for the Agency's non-proliferation objectives and safeguards activities.

The Permanent Mission of .... avails itself of this opportunity to renew to the Director General of the International Atomic Energy Agency the assurances of its highest consideration.

LETTER II

The Permanent Mission of Canada to the IAEA presents its compliments to the Director General and has the honour to enclose copies of three documents that have been the subject of discussion between the Government of Canada and a number of other Governments.

The Government of Canada has decided that, when considering the export of nuclear material, equipment or technology, it will act in accordance with the principles contained in the attached documents as well as other principles considered pertinent by it.

In reaching this decision, the Government of Canada is fully aware of the need to contribute to the development of nuclear power in order to meet world energy requirements, while avoiding contributing in any way to the dangers of a proliferation of nuclear weapons or other nuclear explosive devices, and of the need to remove safeguards and non-proliferation assurances from the field of commercial competition.

The Government of Canada hopes that other Governments may also decide to base their own nuclear export policies upon these documents and such further principles as may be agreed upon.

The Government of Canada requests that the Director General of the International Atomic Energy Agency should circulate the text of this Note and its enclosures to all Member Governments for their information and as a demonstration of support by the Government of Canada for the Agency's non-proliferation objectives and safeguard activities.

The Permanent Mission of Canada to the IAEA avails itself of this opportunity to renew to the Director General the assurances of its highest consideration.

LETTER III

The Permanent Mission of Sweden present their compliments to the Director General of the International Atomic Energy Agency have have the honour to enclose copies of three documents which have been the subject of discussion between the Government of Sweden and a number of other Governments.

The Government of Sweden have decided that, when considering the export of nuclear material, equipment or technology, they will act in accordance with the principles contained in the attached documents.

In reaching this decision, the Government of Sweden are fully aware of the need to avoid contributing in any way to the dangers of a proliferation of nuclear weapons or other nuclear explosive devices, and of the need to remove safeguards and non-proliferation assurances from the field of commercial competition.

The Government of Sweden hope that other Governments may also decide to base their own nuclear export policies upon these documents.

The Government of Sweden request that the Director General of the International Atomic Energy Agency should circulate the text of this Note and its enclosures to all Member Governments for their information and as a demonstration of support by the Government of Sweden for the Agency's non-proliferation objectives and safeguards activities.

The Permanent Mission of Sweden take this opportunity to renew to the Director General of the International Atomic Energy Agency the assurances of their highest consideration.

LETTER IV

The Permanent Mission of .... to the International Organizations in Vienna presents its compliments to the Director General of the International Atomic Energy Agency and has the honour to enclose copies of three documents which have been the subject of discussion between the .... and a number of other Governments.

The Government of .... has decided that, when considering the export of nuclear material, equipment or technology, it will act in accordance with the principles contained in the attached documents.

In reaching this decision, the Government of .... is fully aware of the need to contribute to the development of nuclear power in order to meet world energy requirements, while avoiding contributing in any way to the dangers of a proliferation of nuclear weapons or other nuclear explosive devices, and of the need to remove safeguards and non-proliferation assurances from the field of commercial competition.

As a Member of the European Community, the Government of .... so far as trade within the Community is concerned, will implement these documents in the light of its commitments under the Treaties of Rome where necessary.

The Government of .... hopes that other Governments may also decide to base their own nuclear export policies upon these documents.

The Government of .... requests that the Director General of the International Atomic Energy Agency should circulate the texts of this Note and its enclosures to all Member Governments for their information and as a demonstration of support by the Government of .... for the Agency's non-proliferation objectives and safeguards activities.

The Permanent Mission of .... to the International Organizations in Vienna avails itself of this opportunity to renew to the Director General of the International Atomic Energy Agency the assurances of its highest consideration.

LETTER V

The Permanent Mission of Italy present their compliments and have the honour to enclose copies of three documents which have been the subject of discussion between the Government of Italy and a number of other Governments.

The Government of Italy have decided that, when considering the export of nuclear material, equipment or technology, they will act in accordance with the principles contained in the attached documents.

In reaching this decision, the Government of Italy are fully aware of the need to contribute to the development of nuclear power in order to meet world energy requirements, while avoiding contributing in any way to dangers of a proliferation of nuclear weapons or other nuclear explosive devices, and of the need to remove safeguards and non-proliferation assurances from the field of commercial competition.

The Italian Government underline that the undertaking referred to cannot limit in any way the rights and obligations arising for Italy out of agreements to which she is a Party, and in particular those arising out of Article IV of the Non-Proliferation Treaty.

As a Member of the European Community, the Government of Italy, so far as trade within the Community is concerned, will implement these documents in the light of their commitments under the Treaties of Rome where necessary.

The Government of Italy hope that other Governments may also decide to base their own nuclear export policies upon these documents.

The Government of Italy request that the Director General of the International Atomic Energy Agency should circulate the texts of this Note and its enclosures to all Member Governments for their information and as a demonstration of support by the Government of Italy for the Agency's non-proliferation objectives and safeguards activities.

LETTER VI

The Permanent Mission of Belgium presents its compliments to the Director General of the IAEA and, in addition to its Note P 10-92/24 of 11 January 1978, would like to draw the attention to the following.

The Government of Belgium at present are not in a position to implement fully the principles for technology transfer set out in the documents attached to the above-mentioned Note because of the lack of appropriate laws and regulations. However, the Government of Belgium intend to implement these principles fully when appropriate laws and regulations for this purpose are put into force as necessary.

The Government of Belgium request that the Director General of the IAEA should circulate the text of this Note to all Member Governments for their information.

The Permanent Mission of Belgium takes this opportunity to renew to the Director General of the IAEA the assurance of its highest consideration.

LETTER VII

The Permanent Mission of the Czechoslovak Socialist Republic to the International Organizations presents its compliments to the Director General of the International Atomic Energy Agency and has the honour to refer to its Note No. 1036/78 regarding standards of the nuclear export policies which have been adopted by the members of the Nuclear Suppliers Group.

The Government of the Czechoslovak Socialist Republic greatly appreciates the role of the International Atomic Energy Agency in the sphere of control of the provisions of the Non-Proliferation Treaty. This activity has been an important instrument of preventing proliferation of nuclear weapons. Sharing the opinion that further strengthening of safeguards lies in the interest of universal peace, the Government of the Czechoslovak Socialist Republic has decided that it would deliver nuclear material, equipment and technology defined in a trigger list, to any non-nuclear-weapon State only in a case when the whole nuclear activity of a recipient country, and not only material, equipment and technology being transferred, are subject to the Agency's safeguards.

The Government of the Czechoslovak Socialist Republic expresses its opinion that this principle, if observed by all the States - nuclear suppliers, could have made a great contribution toward strengthening and universality of the Non-Proliferation Treaty.

The Permanent Mission of the Czechoslovak Socialist Republic to the International Organizations avails itself of this opportunity to renew to the Director General of the International Atomic Energy Agency the assurances of its highest consideration.

LETTER VIII

The Permanent Mission of the German Democratic Republic to the International Organizations in Vienna presents its compliments to the Director General of the International Atomic Energy Agency and has the honour, in connection with Note No. 2/78-III addressed to the Director General of the IAEA on 11 January 1978, to state the following: in the view of the Government of the German Democratic Republic, the guidelines for nuclear exports are such as to strengthen the regime of non-proliferation of nuclear weapons and the IAEA safeguards system. The German Democratic Republic will also in future advocate agreements to the effect that nuclear exports under the trigger list mentioned in the above Note should go only to those non-nuclear-weapon States that accept IAEA safeguards for all of their nuclear activities.

The Government of the German Democratic Republic is convinced that any reinforcement of the regime of non-proliferation of nuclear weapons will promote the peaceful uses of nuclear energy and international co-operation in this area.

The Permanent Mission requests that the present text be circulated as an official document of the International Atomic Energy Agency.

The Permanent Mission of the German Democratic Republic to the International Organizations in Vienna avails itself of this opportunity to renew to the Director General of the International Atomic Energy Agency the assurances of its highest consideration.

LETTER IX

The Embassy of Japan presents its compliments to the International Atomic Energy Agency and, in reference to its Note No. J.M. 78/21 of January 11, 1978, has the honour to inform the International Atomic Energy Agency of the following.

The Government of Japan at present is not in a position to implement fully the Principles for Technology Transfers set out in the documents attached to the above-mentioned Note because of the lack of appropriate laws and regulations.

However, the Government of Japan intends to implement these principles fully when appropriate laws and regulations for this purpose are put into force as necessary.

The Government of Japan requests that the Director General of the International Atomic Energy Agency be good enough to circulate the texts of this Note to all Member Governments for their information.

The Embassy of Japan avails itself of this opportunity to renew to the International Atomic Energy Agency the assurances of its highest consideration.

LETTER X

The Permanent Mission of the Polish People's Republic to the International Atomic Energy Agency presents its compliments to the Director General of the IAEA and has the honour to refer to its Note No. 10-96/77 regarding standards of the nuclear export policies which have been adopted by the members of the Nuclear Suppliers Group.

The Government of the Polish People's Republic greatly appreciates the role of the International Atomic Energy Agency in the sphere of control of the provisions of the Non-Proliferation Treaty. This activity has been an important instrument of preventing proliferation of nuclear weapons. Sharing the opinion that further strengthening of safeguards lies in the interest of universal peace, the Government of the Polish People's Republic has decided that it would deliver nuclear material, equipment and technology defined in a trigger list, to any non-nuclear-weapon State only in a case when the whole nuclear activity of a recipient country, and not only material, equipment and technology being transferred, are subject to the Agency's safeguards.

The Government of the Polish People's Republic expresses its opinion that this principle, if observed by all the States - nuclear suppliers, could have made a great contribution toward strengthening and universality of the Non-Proliferation Treaty.

The Government of the Polish People's Republic requests that the Director General of the IAEA should circulate the text of this Note to all Member Governments.

The Permanent Mission of the Polish People's Republic to the International Atomic Energy Agency avails itself of this opportunity to renew to the Director General of the IAEA the assurances of the highest consideration.

LETTER XI

The Permanent Mission of Switzerland presents its compliments to the Director General of the International Atomic Energy Agency and, with reference to its to day's Note No. 003, has the honour to emphasize the following.

The Government of Switzerland at present is not in a position to implement fully the principles for Technology Transfers set out in the documents attached to the above-mentioned Note because of the lack of appropriate laws and regulations. However, the Government of Switzerland intends to implement these principles fully when appropriate laws and regulations for this purpose are put into force as necessary.

The Government of Switzerland requests that the Director General of the International Atomic Energy Agency should circulate the text of this Note to all Member Governments for their information.

The Permanent Mission of Switzerland avails itself of this opportunity to renew to the Director General of the International Atomic Energy Agency the assurances of its highest consideration.

LETTER XII

With reference to Note Verbale No. 1 from the Permanent Mission of the USSR, dated 11 January 1978, I have the honour to send you the following Declaration of the Government of the USSR:

> "The Government of the Union of Soviet Socialist Republics emphasizes its determination to continue its efforts to secure agreement between countries supplying nuclear materials, equipment and technology on the principle that IAEA safeguards must be applied to all nuclear activities of non-nuclear-weapon States when those States receive any of the items mentioned in the initial list referred to in the above-mentioned Note Verbale. In this connection the Government of the USSR takes the view that the principle of full control is a necessary condition for ensuring effective safeguards which can prevent nuclear materials, equipment and technology from being used for manufacturing nuclear weapons or other nuclear explosive devices."

The Government requests that the text of the present letter be distributed as an official document of the IAEA.

APPENDIX

GUIDELINES FOR NUCLEAR TRANSFERS

1. The following fundamental principles for safeguards and export controls should apply to nuclear transfers to any non-nuclear-weapon State for peaceful purposes. In this connection, suppliers have defined an export trigger list and agreed on common criteria for technology transfers.

Prohibition on nuclear explosives

2. Suppliers should authorize transfer of items identified in the trigger list only upon formal governmental assurances from recipients explicitly excluding uses which would result in any nuclear explosive device.

Physical protection

3. (a) All nuclear materials and facilities identified by the agreed trigger list should be placed under effective physical protection to prevent unauthorized use and handling. The levels of physical protection to be ensured in relation to the type of materials, equipment and facilities, have been agreed by suppliers, taking account of international recommendations.

(b) The implementation of measures of physical protection in the recipient country is the responsibility of the Government of that country. However, in order to implement the terms agreed upon amongst suppliers, the levels of physical protection on which these measures have to be based should be the subject of an agreement between supplier and recipient.

(c) In each case special arrangements should be made for a clear definition of responsibilities for the transport of trigger list items.

Safeguards

4. Suppliers should transfer trigger list items only when covered by IAEA safeguards, with duration and coverage provisions in conformance with the GOV/1621 guidelines. Exceptions should be made only after consultation with the parties to this understanding.

5. Suppliers will jointly reconsider their common safeguards requirements, whenever appropriate.

Safeguards triggered by the transfer of certain technology

6. (a) The requirements of paragraphs 2, 3 and 4 above should also apply to facilities for reprocessing, enrichment, or heavy-water production, utilizing technology directly transferred by the supplier or derived from transferred facilities, or major critical components thereof.

(b) The transfer of such facilities, or major critical components thereof, or related technology, should require an undertaking (1) that IAEA safeguards apply to any facilities of the same type (i.e. if the design, construction or operating processes are based on the same or similar physical or chemical processes, as defined in the trigger list) constructed during an agreed period in the recipient country and (2) that there should at all times be in effect a safeguards agreement permitting the IAEA to apply Agency safeguards with respect to such facilities identified by the recipient, or by the supplier in consultation with the recipient, as using transferred technology.

Special controls on sensitive exports

7. Suppliers should exercise restraint in the transfer of sensitive facilities, technology and weapons-usable materials. If enrichment or reprocessing facilities, equipment or technology are to be transferred, suppliers should encourage recipients to accept, as an alternative to national plants, supplier involvement and/or other appropriate multinational participation in resulting facilities. Suppliers should also promote international (including IAEA) activities concerned with multinational regional fuel cycle centres.

Special controls on export of enrichment facilities, equipment and technology

8. For a transfer of an enrichment facility, or technology therefor, the recipient nation should agree that neither the transferred facility, nor any facility based on such technology, will be designed or operated for the production of greater than 20% enriched uranium without the consent of the supplier nation, of which the IAEA should be advised.

Controls on supplied or derived weapons-usable material

9. Suppliers recognize the importance, in order to advance the objectives of these guidelines and to provide opportunities further to reduce the risks of proliferation, of including in agreements on supply of nuclear materials or of facilities which produce weapons-usable material, provisions calling for mutual agreement between the supplier and the recipient on arrangements for reprocessing, storage, alteration, use, transfer or retransfer of any weapons-usable material involved. Suppliers should endeavour to include such provisions whenever appropriate and practicable.

Controls on retransfer

10. (a) Suppliers should transfer trigger list items, including technology defined under paragraph 6, only upon the recipient's assurance that in the case of:

(1) retransfer of such items,

or

(2) transfer of trigger list items derived from facilities originally transferred by the supplier, or with the help of equipment or technology originally transferred by the supplier;

the recipient of the retransfer or transfer will have provided the same assurances as those required by the supplier for the original transfer.

(b) In addition the supplier's consent should be required for: (1) any retransfer of the facilities, major critical components, or technology described in paragraph 6; (2) any transfer of facilities or major critical components derived from those items; (3) any retransfer of heavy water or weapons-usable material.

SUPPORTING ACTIVITIES

Physical security

11. Suppliers should promote international co-operation on the exchange of physical security information, protection of nuclear materials in transit, and recovery of stolen nuclear materials and equipment.

Support for effective IAEA safeguards

12. Suppliers should make special efforts in support of effective implementation of IAEA safeguards. Suppliers should also support the Agency's efforts to assist Member States in the improvement of their national systems of accounting and control of nuclear material and to increase the technical effectiveness of safeguards.

Similarly, they should make every effort to support the IAEA in increasing further the adequacy of safeguards in the light of technical developments and the rapidly growing number of nuclear facilities, and to support appropriate initiatives aimed at improving the effectiveness of IAEA safeguards.

Sensitive plant design features

13. Suppliers should encourage the designers and makers of sensitive equipment to construct it in such a way as to facilitate the application of safeguards.

Consultations

14. (a) Suppliers should maintain contact and consult through regular channels on matters connected with the implementation of these guidelines.

(b) Suppliers should consult, as each deems appropriate, with other Governments concerned on specific sensitive cases, to ensure that any transfer does not contribute to risks of conflict or instability.

(c) In the event that one or more suppliers believe that there has been a violation of supplier/recipient understandings resulting from these guidelines, particularly in the case of an explosion of a nuclear device, or illegal termination or violation of IAEA safeguards by a recipient, suppliers should consult promptly through diplomatic channels in order to determine and assess the reality and extent of the alleged violation.

Pending the early outcome of such consultations, suppliers will not act in a manner that could prejudice any measure that may be adopted by other suppliers concerning their current contacts with that recipient.

Upon the findings of such consultations, the suppliers, bearing in mind Article XII of the IAEA Statute, should agree on an appropriate response and possible action which could include the termination of nuclear transfers to that recipient.

15. In considering transfers, each supplier should exercise prudence having regard to all the circumstances of each case, including any risk that technology transfers not covered by paragraph 6, or subsequent retransfers, might result in unsafeguarded nuclear materials.

16. Unanimous consent is required for any changes in these guidelines, including any which might result from the reconsideration mentioned in paragraph 5.

ANNEX A

TRIGGER LIST REFERRED TO IN GUIDELINES

PART A. Material and equipment

1. Source or special fissionable material as defined in Article XX of the Statute of the International Atomic Energy Agency; provided that items specified in sub-paragraph (a) below, and exports of source or special fissionable material to a given recipient country, within a period of 12 months, below the limits specified in sub-paragraph (b) below, shall not be included:

(a) Plutonium with an isotopic concentration of plutonium-238 exceeding 80%.

Special fissionable material when used in gram quantities or less as a sensing component in instruments; and

Source material which the Government is satisfied is to be used only in non-nuclear activities, such as the production of alloys or ceramics;

(b)	Special fissionable material	50 effective grams;
	Natural uranium	500 kilograms;
	Depleted uranium	1000 kilograms; and
	Thorium	1000 kilograms.

2. 1. Reactors and equipment therefor:

2. 1. 1. Nuclear reactors capable of operation so as to maintain a controlled self-sustaining fission chain reaction, excluding zero energy reactors, the latter being defined as reactors with a designed maximum rate of production of plutonium not exceeding 100 grams per year.

2. 1. 2. Reactor pressure vessels:

Metal vessels, as complete units or as major shop-fabricated parts therefor, which are especially designed or prepared to contain the core of a nuclear reactor as defined in paragraph 2. 1. 1 above and are capable of withstanding the operating pressure of the primary coolant.

2. 1. 3. Reactor fuel charging and discharging machines:

Manipulative equipment especially designed or prepared for inserting or removing fuel in a nuclear reactor as defined in paragraph 2. 1. 1 above capable of on-load operation or employing technically sophisticated positioning or alignment features to allow complex off-load fuelling operations such as those in which direct viewing of or access to the fuel is not normally available.

2. 1. 4. Reactor control rods:

Rods especially designed or prepared for the control of the reaction rate in a nuclear reactor as defined in paragraph 2. 1. 1 above.

2.1.5. Reactor pressure tubes:

Tubes which are especially designed or prepared to contain fuel elements and the primary coolant in a reactor as defined in paragraph 2.1.1 above at an operating pressure in excess of 50 atmospheres.

2.1.6. Zirconium tubes:

Zirconium metal and alloys in the form of tubes or assemblies of tubes, and in quantities exceeding 500 kg per year, especially designed or prepared for use in a reactor as defined in paragraph 2.1.1 above, and in which the relationship of hafnium to zirconium is less than 1:500 parts by weight.

2.1.7. Primary coolant pumps:

Pumps especially designed or prepared for circulating liquid metal as primary coolant for nuclear reactors as defined in paragraph 2.1.1 above.

2.2. Non-nuclear materials for reactors:

2.2.1. Deuterium and heavy water:

Deuterium and any deuterium compound in which the ratio of deuterium to hydrogen exceeds 1:5000 for use in a nuclear reactor as defined in paragraph 2.1.1 above in quantities exceeding 200 kg of deuterium atoms for any one recipient country in any period of 12 months.

2.2.2. Nuclear grade graphite:

Graphite having a purity level better than 5 parts per million boron equivalent and with a density greater than 1.50 grams per cubic centimetre in quantities exceeding 30 metric tons for any one recipient country in any period of 12 months.

2.3.1. Plants for the reprocessing of irradiated fuel elements, and equipment especially designed or prepared therefor.

2.4.1. Plants for the fabrication of fuel elements.

2.5.1. Equipment, other than analytical instruments, especially designed or prepared for the separation of isotopes of uranium.

2.6.1. Plants for the production of heavy water, deuterium and deuterium compounds and equipment especially designed or prepared therefor.

Clarifications of certain of the items on the above list are annexed.

PART B. Common criteria for technology transfers under paragraph 6 of the Guidelines

(1) "Technology" means technical data in physical form designated by the supplying country as important to the design, construction, operation, or maintenance of enrichment, reprocessing, or heavy water production facilities or major critical components thereof, but excluding data available to the public, for example, in published books and periodicals, or that which has been made available internationally without restrictions upon its further dissemination.

(2) "Major critical components" are:

(a) in the case of an isotope separation plant of the gaseous diffusion type: diffusion barrier;

(b) in the case of an isotope separation plant of the gas centrifuge type: gas centrifuge assemblies, corrosion-resistant to UF_6;

(c) in the case of an isotope separation plant of the jet nozzle type: the nozzle units;

(d) in the case of an isotope separation plant of the vortex type: the vortex units.

(3) For facilities covered by paragraph 6 of the Guidelines for which no major critical component is described in paragraph 2 above, if a supplier nation should transfer in the aggregate a significant fraction of the items essential to the operation of such a facility, together with the knowhow for construction and operation of that facility, that transfer should be deemed to be a transfer of "facilities or major critical components thereof".

(4) The definitions in the preceding paragraphs are solely for the purposes of paragraph 6 of the Guidlines and this Part B, which differ from those applicable to Part A of this Trigger List, which should not be interpreted as limited by such definition.

(5) For the purposes of implementing paragraph 6 of the Guidelines, the following facilities should be deemed to be "of the same type (i. e. if their design, construction or operating processes are based on the same or similar physical or chemical processes)":

Where the technology transferred is such as to make possible the construction in the recipient State of a facility of the following type, or major critical components thereof:	The following will be deemed to be facilities of the same type:
(a) an isotope separation plant of the gaseous diffusion type	any other isotope separation plant using the gaseous diffusion process.
(b) an isotope separation plant of the gas centrifuge type	any other isotope separation plant using the gas centrifuge process.
(c) an isotope separation plant of the jet nozzle type	any other isotope separation plant using the jet nozzle process.
(d) an isotope separation plant of the vortex type	any other isotope separation plant using the vortex process.
(e) a fuel reprocessing plant using the solvent extraction process . . .	any other fuel reprocessing plant using the solvent extraction process.

(f)	a heavy water plant using the exchange process	any other heavy water plant using the exchange process.
(g)	a heavy water plant using the electrolytic process	any other heavy water plant using the electrolytic process.
(h)	a heavy water plant using the hydrogen distillation process	any other heavy water plant using the hydrogen distillation process.

Note: In the case of reprocessing, enrichment, and heavy water facilities whose design, construction, or operation processes are based on physical or chemical processes other than those enumerated above, a similar approach would be applied to define facilities "of the same type", and a need to define major critical components of such facilities might arise.

(6) The reference in paragraph 6(b) of the Guidelines to "any facilities of the same type constructed during an agreed period in the recipient's country" is understood to refer to such facilities (or major critical components thereof), the first operation of which commences within a period of at least 20 years from the date of the first operation of (1) a facility which has been transferred or incorporates transferred major critical components or of (2) a facility of the same type built after the transfer of technology. It is understood that during that period there would be a conclusive presumption that any facility of the same type utilized transferred technology. But the agreed period is not intended to limit the duration of the safeguards imposed or the duration of the right to identify facilities as being constructed or operated on the basis of or by the use of transferred technology in accordance with paragraph 6(b)(2) of the Guidelines.

Annex

CLARIFICATIONS OF ITEMS ON THE TRIGGER LIST

A. Complete nuclear reactors (Item 2. 1. 1 of the Trigger List)

1. A "nuclear reactor" basically includes the items within or attached directly to the reactor vessel, the equipment which controls the level of power in the core, and the components which normally contain or come in direct contact with or control the primary coolant of the reactor core.

2. The export of the whole set of major items within this boundary will take place only in accordance with the orocedures of the Guidelines. Those individual items within this functionally defined boundary which will be exported only in accordance with the procedures of the Guidelines are listed in paragraphs 2. 1. 1 to 2. 1. 5.

The Government reserves to itself the right to apply the procedures of the Guidelines to other items within the functionally defined boundary.

3. It is not intended to exclude reactors which could reasonably be capable of modification to produce significantly more than 100 grams of plutonium per year. Reactors designed for sustained operation at significant power levels, regardless of their capacity for plutonium production, are not considered as "zero energy reactors".

B. Pressure vessels (Item 2. 1. 2 of the Trigger List)

4. A top plate for a reactor pressure vessel is covered by item 2. 1. 1 as a major shop-fabricated part of a pressure vessel.

5. Reactor internals (e. g. support columns and plates for the core and other vessel internals, control rod guide tubes, thermal shields, baffles, core grid plates, diffuser plates, etc.) are normally supplied by the reactor supplier. In some cases, certain internal support components are included in the fabrication of the pressure vessel. These items are sufficiently critical to the safety and reliability of the operation of the reactor (and, therefore, to the guarantees and liability of the reactor supplier), so that their supply, outside the basic supply arrangement for the reactor itself, would not be common practice. Therefore, although the separate supply of these unique, especially designed and prepared, critical, large and expensive items would not necessarily be considered as falling outside the area of concern, such a mode of supply is considered unlikely.

C. Reactor control rods (Item 2. 1. 4 of the Trigger List)

6. This item includes, in addition to the neutron absorbing part, the support or suspension structures therefor if supplied separately.

D. Fuel reprocessing plants (Item 2. 3. 1 of the Trigger List)

7. A "plant for the reprocessing of irradiated fuel elements" includes the equipment and components which normally come in direct contact with and directly control the irradiated fuel and the major nuclear material and fission product processing streams. The export of the whole set of major items within this boundary will take place only in accordance with

the procedures of the Guidelines. In the present state of technology, the following items of equipment are considered to fall within the meaning of the phrase "and equipment especially designed or prepared therefor":

(a) Irradiated fuel element chopping machines: remotely operated equipment especially designed or prepared for use in a reprocessing plant as identified above and intended to cut, chop or shear irradiated nuclear fuel assemblies, bundles or rods; and

(b) Critically safe tanks (e.g. small diameter, annular or slab tanks) especially designed or prepared for use in a reprocessing plant as identified above, intended for dissolution of irradiated nuclear fuel and which are capable of withstanding hot, highly corrosive liquid, and which can be remotely loaded and maintained;

8. The Government reserves to itself the right to apply the procedures of the Guidelines to other items within the functionally defined boundary.

E. Fuel fabrication plants
(Item 2.4.1 of the Trigger List)

9. A "plant for the fabrication of fuel elements" includes the equipment:

(a) Which normally comes in direct contact with, or directly processes, or controls, the production flow of nuclear material, or

(b) Which seals the nuclear material within the cladding.

10. The export of the whole set of items for the foregoing operations will take place only in accordance with the procedures of the Guidelines. The Government will also give consideration to application of the procedures of the guidelines to individual items intended for any of the foregoing operations, as well as for other fuel fabrication operations such as checking the integrity of the cladding or the seal, and the finish treatment to the sealed fuel.

F. Isotope separation plant equipment
(Item 2.5.1 of the Trigger List)

11. "Equipment, other than analytical instruments, especially designed or prepared for the separation of isotopes of uranium" includes each of the major items of equipment especially designed or prepared for the separation process. Such items include:

- gaseous diffusion barriers,
- gaseous diffuser housings,
- gas centrifuge assemblies, corrosion-resistant to UF_6,
- jet nozzle separation units,
- vortex separation units,
- large UF_6 corrosion-resistant axial or centrifugal compressors,
- special compressor seals for such compressors.

ANNEX B

CRITERIA FOR LEVELS OF PHYSICAL PROTECTION

1. The purpose of physical protection of nuclear materials is to prevent unauthorized use and handling of these materials. Paragraph 3(a) of the Guidelines document calls for agreement among suppliers on the levels of protection to be ensured in relation to the type of materials, and equipment and facilities containing these materials, taking account of international recommendations.

2. Paragraph 3(b) of the Guidelines document states that implementation of measures of physical protection in the recipient country is the responsibility of the Government of that country. However, the levels of physical protection on which these measures have to be based should be the subject of an agreement between supplier and recipient. In this context these requirements should apply to all States.

3. The document INFCIRC/225 of the International Atomic Energy Agency entitled "The Physical Protection of Nuclear Material" and similar documents which from time to time are prepared by international groups of experts and updated as appropriate to account for changes in the state of the art and state of knowledge with regard to physical protection of nuclear material are a useful basis for guiding recipient States in designing a system of physical protection measures and procedures.

4. The categorization of nuclear material presented in the attached table or as it may be updated from time to time by mutual agreement of suppliers shall serve as the agreed basis for designating specific levels of physical protection in relation to the type of materials, and equipment and facilities containing these materials, pursuant to paragraph 3(a) and 3(b) of the Guidelines document.

5. The agreed levels of physical protection to be ensured by the competent national authorities in the use, storage and transportation of the materials listed in the attached table shall as a minimum include protection characteristics as follows:

CATEGORY III

Use and Storage within an area to which access is controlled.

Transportation under special precautions including prior arrangements among sender, recipient and carrier, and prior agreement between entities subject to the jurisdiction and regulation of supplier and recipient States, respectively, in case of international transport specifying time, place and procedures for transferring transport responsibility.

CATEGORY II

Use and Storage within a protected area to which access is controlled, i.e. an area under constant surveillance by guards or electronic devices, surrounded by a physical barrier with a limited number of points of entry under appropriate control, or any area with an equivalent level of physical protection.

Transportation under special precautions including prior arrangements among sender, recipient and carrier, and prior agreement between entities subject to the jurisdiction and regulation of supplier and recipient States, respectively, in case of international transport, specifying time, place and procedures for transferring transport responsibility.

CATEGORY I

Materials in this Category shall be protected with highly reliable systems against unauthorized use as follows:

Use and Storage within a highly protected area, i. e. a protected area as defined for Category II above, to which, in addition, access is restricted to persons whose trustworthiness has been determined, and which is under surveillance by guards who are in close communication with appropriate response forces. Specific measures taken in this context should have as their objective the detection and prevention of any assault, unauthorized access or unauthorized removal of material.

Transportation under special precautions as identified above for transportation of Category II and III materials and, in addition, under constant surveillance by escorts and under conditions which assure close communication with appropriate response forces.

6. Suppliers should request identification by recipients of those agencies or authorities having responsibility for ensuring that levels of protection are adequately met and having responsibility for internally co-ordinating response/recovery operations in the event of unauthorized use or handling of protected materials. Suppliers and recipients should also designate points of contact within their national authorities to co-operate on matters of out-of-country transportation and other matters of mutual concern.

TABLE: CATEGORIZATION OF NUCLEAR MATERIAL

Material	Form	Category		
		I	II	III
1. Plutonium[a]	Unirradiated[b]	2 kg or more	Less than 2 kg but more than 500 g	500 g or less[c]
2. Uranium-235	Unirradiated[b]			
	- uranium enriched to 20% ^{235}U or more	5 kg or more	Less than 5 kg but more than 1 kg	1 kg or less[c]
	- uranium enriched to 10% ^{235}U but less than 20%	-	10 kg or more	Less than 10 kg[c]
	- uranium enriched above natural, but less than 10% ^{235}U[d]			10 kg or more
3. Uranium-233	Unirradiated[b]	2 kg or more	Less than 2 kg but more than 500 g	500 g or less[c]
4. Irradiated fuel			Depleted or natural uranium, thorium or low-enriched fuel (less than 10% fissile content)[e], [f]	

---

a/ As identified in the Trigger List.

b/ Material not irradiated in a reactor or material irradiated in a reactor but with a radiation level equal to or less than 100 rads/hour at one metre unshielded.

c/ Less than a radiologically significant quantity should be exempted.

d/ Natural uranium, depleted uranium and thorium and quantities of uranium enriched to less than 10% not falling in Category III should be protected in accordance with prudent management practice.

e/ Although this level of protection is recommended, it would be open to States, upon evaluation of the specific circumstances, to assign a different category of physical protection.

f/ Other fuel which by virtue of its original fissile material content is classified as Category I or II before irradiation may be reduced one category level while the radiation level from the fuel exceeds 100 rads/hour at one metre unshielded.

NUCLEAR INDUSTRIAL BASES IN NON-NUCLEAR-WEAPONS STATES

CONTENTS

Page
Introduction 503
Comparison of present nuclear industrial bases of 23 selected nonnuclear-weapons states (CRS, 1984) 504
Nuclear plants under construction or operating in the developing countries outside Europe (SIPRI, 1985) 505
Power reactors in selected countries (Spector, 1984) 508
Research reactors in selected countries (Spector, 1984) 509
Enrichment plants in selected countries (Spector, 1984) 510
Reprocessing plants in selected countries (Spector, 1984) 511
Heavy water plants in selected countries (Spector, 1984) 512
Uranium resources in selected countries (Spector, 1984) 513
Active uranium mines in selected countries (Spector, 1984) 514
Operating uranium mills in selected countries (Spector, 1984) 515
Uranium purification plants in selected countries (Spector, 1984) 516
Fuel fabrication plants in selected countries (Spector, 1984) 517
UF_6 conversion plants in selected countries (Spector, 1984) 518
Fuel cycle components in selected countries—Summary chart (Spector, 1984)... 519
A speculative comparison of the nuclear industrial bases of eight nonnuclear-weapons states in 1995 (CRS, 1984) 520
Listing of 23 nonnuclear-weapons states by nuclear capability in 1995 (CRS, 1984) 521
Nuclear facilities in nonnuclear weapons states not subject to IAEA safeguards as of December 31, 1984 (SIPRI, 1983 and Spector, 1984) 523
Proliferation status of six states that do not accept full-scope safeguards (CRS, 1984) 522
Proliferation pressures and constraints (Hudson Institute, 1976) 525
Proliferation pressures for 23 nonnuclear-weapons states (CRS, 1984) 526
Non-Proliferation constraints for 23 nonnuclear-weapons states (CRS, 1984) 527

NUCLEAR INDUSTRIAL BASES OF NONNUCLEAR-WEAPONS STATES

INTRODUCTION

When the Non-Proliferation Treaty was opened for signatures in 1968, "nuclear proliferation" was defined to be a nation's first test of a nuclear device. However, in response to events in the mid-1970's, notably India's nuclear test and the signing of controversial nuclear supply contracts with Brazil and Pakistan, this definition has been informally broadened by many analysts and Members of Congress to include the spread of sensitive nuclear facilities, that is, those that separate plutonium from spent nuclear fuel (reprocessing) or concentrate U-235 (enrichment). The acquisition of nuclear power reactors, large testing and research reactors, heavy water plants, and other industrial components of the nuclear fuel cycle can also contribute to a nation's ability to produce weapons materials. One indication of the shift in definition appears in the voluntary nuclear suppliers' guidelines, which commit members to restraint in the export of sensitive nuclear equipment and facilities. This chapter provides information on the possession of such facilities by key nonnuclear-weapons states.

TABLE 1. Comparison of Present Nuclear Industrial Bases of 23 Selected Non-Nuclear Weapon States, 1983.

State	Installed Nuclear capacity (MW(e))	Enrichment capacity	Breeder development	Reprocessing capacity	Plutonium fuel plans	Heavy water capacity	Technical personnel	Nuclear capability index*	
								Test	Produce
Argentina	400	Minor	No	UC	Yes	UC	Some	3	1
Australia	0	No	No	No	No	No	Some	0	0
Belgium	3600	No	Some	Minor	Some	No	Strong	1	0
Brazil	676	UC	No	No	Some	No	Some	0	0
Canada	7,700	No	No	No	No	Some	Strong	2	1
Cuba	0	No	No	No	No	No	Minor	0	0
Egypt	0	No	No	No	No	No	Minor	0	0
FR Germany	10,400	No	Yes	Minor	Yes	No	Strong	2	2
India	804	No	Yes	Yes	Yes	Some	Good	4	1
Iran	0	No	No	No	No	No	Minor	0	0
Iraq	0	No	No	No	No	No	Minor	0	0
Israel	0	No	No	Minor	No	No	Strong	4	2
Italy	1,300	No	Some	No	Some	No	Some	1	1
Japan	17,300	No	Yes	Yes	Yes	No	Strong	3	4
Libya	0	No	No	No	No	No	Minor	0	0
Netherlands	450	Some	No	No	Some	No	Some	1	0
Pakistan	125	UC	No	UC	Unknown	No	Some	1	0
South Africa	0	Some	No	No	No	No	Some	2	1
South Korea	1,185	No	No	No	No	No	Some	1	0
Spain	2,000	No	No	No	No	No	Some	1	0
Sweden	7,700	No	No	No	No	No	Strong	2	0
Taiwan	3,200	No	No	No	No	No	Some	1	0
Yugoslavia	0	No	No	No	No	No	Some	0	0

UC = Under construction

*Subjective index rating scheme: 5=advanced, 4=strong, 3=moderate, 2=some, 1=slight, 0=none. The ratings represent personal judgment of the author.

Source: Congressional Research Service, An Assessment of the Proliferation Threat of Today and Tomorrow, September 24, 1984, p. 9. A report prepared for Senator William Proxmire by CRS Senior Specialist Warren H. Donnelly and released by Senator Proxmire's office on October 27, 1984. Revised Nov. 20, 1984.

Nuclear plants[1] under construction or operating in the developing countries outside Europe (power and research reactors and significant fuel facilities)

Unsafeguarded plants are underlined.

Argentina	3	HWR power reactors
	6	small research reactors[2]
	3	fuel fabrication plants
	2	heavy water production plants (1 unsafeguarded)
	1	pilot reprocessing plant (under safeguards when, as today, reprocessing safeguarded fuel)
	1	pilot enrichment plant[3]
	1	uranium oxide conversion plant (possibly a second unsafeguarded plant)
	1	UF_6 plant
Brazil	3	LWR power reactors
	3	small research reactors
	1	pilot reprocessing plant (construction status not clear)
	1	pilot enrichment plant
	1	fuel fabrication plant
	1	uranium oxide conversion plant
	1	UF_6 plant
Cuba	2	LWR power reactors[4]
	1	small LWR research reactor[4]
India	10	power reactors (8 HWRs and 2 LWRs, 6 HWRs unsafeguarded)
	6	research reactors (including 1 large HWR)[5]
	3	reprocessing plants[5] (1 under safeguards while reprocessing safeguarded fuel)
	2	fuel fabrication plants (1 unsafeguarded)
	7	heavy water production plants
	3	uranium oxide conversion plants (2 unsafeguarded)
	1	thorium oxide fuel fabrication plant
	1	fast breeder fuel fabrication plant

...

Israel	2 research reactors (including 1 large HWR[5]) 1 reprocessing plant[3] 1 heavy water production plant 1 fuel fabrication plant
Korea, South	9 power reactors (8 LWRs and 1 HWR) 3 small research reactors 2 fuel fabrication plants (1 pilot) 1 uranium oxide conversion plant
Mexico	1 LWR power reactor (construction of second power reactor reportedly suspended) 2 small research reactors
Pakistan	1 HWR power reactor 1 small research reactor 2 reprocessing plants (possibly 3 including 2 pilot reprocessing plants) 1 pilot enrichment plant[4] 1 fuel fabrication plant 2 heavy water production plants (1 upgrader) 1 UF_6 plant
Philippines	1 LWR power reactor 1 small research reactor
South Africa[7]	2 LWR power reactors 1 large LWR research reactor 2 enrichment plants (1 pilot plant in operation,[3] 1 commercial plant under construction) 1 fuel fabrication plant 2 uranium oxide conversion plants 1 UF_6 plant (also extensive uranium mining, milling and processing)
Taiwan	6 LWR power reactors 6 research reactors (including 1 large HWR) 1 fuel fabrication plant 1 uranium oxide conversion plant

The nuclear plant in each of the following developing countries is confined essentially to a single small research reactor, usually an LWR using enriched US or Soviet fuel:

Colombia
Peru (building a second)
Uruguay
Venezuela
Zaire
Egypt

Iran
Iraq[8]
Libya[9]
Thailand
Viet Nam
Malaysia

A further four developing countries each have two research reactors[10]:

Chile
Turkey
Indonesia
Korea, North

Notes

[1] Other than uranium mills producing U_3O_8.

[2] 'Small' means less than 5 MW(th). The fuel content of such reactors is normally well below a 'significant quantity', i.e., the amount needed to make a single nuclear explosive. LWRs use enriched uranium fuel chiefly of US, Soviet or West German origin (French, in the case of South Africa and India).

[3] Producing unsafeguarded enriched uranium.

[4] All supplied by the USSR and using Soviet low-enriched fuel.

[5] Producing unsafeguarded plutonium.

[6] Believed to be nearing completion.

[7] Although not usually classified as a developing country, South Africa is included in this list as one of the 5 NNWS that produce unsafeguarded nuclear weapon material.

[8] Since the Tamuz 1 reactor was destroyed.

[9] There are unconfirmed reports that Libya is also obtaining a power reactor (LWR) from the USSR.

[10] Among the industrial countries, Greece, Portugal and Norway each operate a single small research reactor while Denmark has two (none has or is building a power reactor). Albania has recently shown interest in acquiring a research reactor.

Source: David Fischer & Paul Szasz, Safeguarding the Atom, SIPRI, 1985, pp. 183-185.

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POWER REACTORS IN SELECTED COUNTRIES
Spector, 1984

Country	Safeguarded	Unsafeguarded
Argentina	Atucha I (hw, nu) Embalse (hw, nu) Atucha II (hw, nu)*	None
Brazil	Angra I (lw, leu) Angra II (lw, leu)* Angra III (lw, leu)*	None
India	Tarapur I (lw, leu) Tarapur II (lw, leu) Rajasthan I (hw, nu) Rajasthan II (hw, nu)	Madras I (hw, nu) Madras II (hw, nu)* Narora I (hw, nu)* Narora II (hw, nu)* Kakrapar I (hw, nu)* Kakrapar II (hw, nu)*
Iraq	None	None
Israel	None	None
Libya	None	None
Pakistan	KANUPP (hw, nu)	None
South Africa	Koeberg I (lw, leu) Koeberg II (lw, leu)*	None

hw = Heavy Water
lw = Light Water
nu = Natural Uranium
leu = Low Enriched Uranium

*Not yet operating

Source: Based on information contained in: Leonard Spector, Nuclear Proliferation Today. A Carnegie Endowment Book, 1984.

RESEARCH REACTORS IN SELECTED COUNTRIES
Spector, 1984

Country	Safeguarded	Unsafeguarded
Argentina	RA-1 (tank, meu) RA-2 (tank, heu) RA-3 (pool, heu) RA-4 (homogenous, meu)	RA-0 (tank, meu) RA-6 (MTR, heu)[1] RA-7 (hw, nu)*
Brasil	IEAR-1 (pool, heu) RIEN-1 (Argonaut, meu) Triga-UMG (Triga I, meu)	None?
India	None	Apsara (lw, meu) CIRUS (hw, nu) Zerlina (hw, variable fuel) Purnima (no moderator, Pu) R-5 (hw, nu)[2] FBTR (fast breeder, Pu & heu)[2]
Iraq	Osirak (lw, heu)[3] Isis (lw, heu) IRT-2000 (lw, heu)	None
Israel	IRR 1 (lw, heu)	IRR 2 (hw, nu)
Libya	Tajoura (lw, heu)	None
Pakistan	PARR (lw, heu)	
South Africa	Safari I (lw, heu) Safari II (hw, leu)[4]	

* Not yet operating

nu = Natural Uranium
leu = Low Enriched Uranium
meu = Medium Enriched Uranium
heu = Highly Enriched Uranium
lw = Light Water
hw = Heavy Water

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[1] Safeguarded only when safeguarded fuel is present
[2] Not known if operations have begun
[3] Destroyed by Israel in June 1981 prior to start-up; future status uncertain
[4] Presently decommissioned

Source: Ibid.

ENRICHMENT PLANTS IN SELECTED COUNTRIES
Spector, 1984

Country	Safeguarded	Unsafeguarded
Argentina	None	Pilcaniyeu (Experimental)
Brazil	Resende* Belo Horizonte	IPEN* (Lab scale)
India	None	None
Iraq	None	None
Israel	None	Laser (unconfirmed)
Libya	None	None
Pakistan	None	Kahuta Sihala (Experimental)
South Africa	None	Valindaba (50 kg HEU/yr) Valindaba* (50 metric tons LEU/yr)

* Not yet operating

Source: Ibid.

REPROCESSING PLANTS IN SELECTED COUNTRIES
Spector, 1984

Country	Safeguarded	Unsafeguarded
Argentina	None	Ezeiza*[1] (5 mt**/yr)
Brazil	Resende (10 kg/day)	IPEN*[1]
India	None	Trombay (30 mt/yr, Tarapur[2] (100 mt/yr) Kalpakkam* (mt/yr)
Iraq	Unnamed facility (App. 1 mt/yr)	None
Israel	None	Dimona (Est. 3 mt/yr) Nahal Soreq (Lab scale)
Libya	None	None
Pakistan	None	Chashma*[3] (100 mt/yr) New Labs* (10 mt/yr)
South Africa	None	None

* Not yet operating
** mt = Metric Tons

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[1] Safeguarded only when safeguarded fuel is processed

[2] Safeguarded when processing Tarapur and Rajasthan reactor fuel only

[3] Uncertain as to whether construction is continuing

Source: Ibid

HEAVY WATER PLANTS IN SELECTED COUNTRIES
Specter, 1984

Country	Safeguarded	Unsafeguarded
Argentina	Arroyito*	Atucha
Brazil	None	None
India	None	Nangal Baroda Tuticorin Talcher Kota Thal* Manuguru*
Iraq	None	None
Israel	None	Rehovot
Libya	None	None
Pakistan		Multan Karachi[1]
South Africa	None	None

* Not yet operating

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[1] Safeguards status unknown

Source: Ibid.

URANIUM RESOURCES IN SELECTED COUNTRIES
Spector, 1984

Country	Reserves (In metric tons)
Argentina	23,00
Brazil	163,000
India	42,500
Iraq	None
Israel	30,000 - 60,000 available from processing phosphate ores
Libya	None assessed, four active exploration projects
Pakistan	Sufficient for Kahuta enrichment plant
South Africa	South Africa: 313,000 Namibia: 135,000

Source: Ibid.

ACTIVE URANIUM MINES IN SELECTED COUNTRIES
Spector, 1984

Country	Active Mining Sites
Argentina	San Rafael, Los Gigantes
Brazil	Pocos de Caldas
India	Jaduguda
Iraq	None
Israel	Phosphate deposits in Negev desert
Libya	None
Pakistan	Dera Ghazi Khan
South Africa	South Africa: Witwatersrand Basin, Palabora Namibia: Rossing

Source: Ibid.

OPERATING URANIUM MILLS IN SELECTED COUNTRIES
Spector, 1984

Country	Number of Mills in Operation
Argentina	4
Brazil	1
India	1
Iraq	0
Israel	3 (Phosphoric acid plants producing yellowcake as by-product)
Libya	0
Pakistan	1
South Africa	South Africa: 15 Namibia: 1

Source: Ibid.

URANIUM PURIFICATION PLANTS (UO_2) IN SELECTED COUNTRIES
Spector, 1984

Country	Safeguarded	Unsafeguarded
Argentina	None	Cordoba[1]
Brazil	None	IPEN
India	None	Hyderabad
Iraq	Tuwaitha*	None
Israel	None	Unnamed facility
Libya	None	None
Pakistan	None	Unnamed facility
South Africa	None	None

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[1] One of two lines is safeguarded because of West German equipment

Source: Ibid

FUEL FABRICATION PLANTS IN SELECTED COUNTRIES
Specter, 1984

Country	Safeguarded	Unsafeguarded
Argentina	None	Ezeiza[1]
Brazil	Resende	None
India	None	Hyderabad
Iraq	Tuwaitha*	None
Israel	None	Dimona
Libya	None	None
Pakistan	None	Chashma
South Africa	None	None

* Not yet operating

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[1] One of two lines is safeguarded when fabricating safeguarded UO_2

Source: Ibid.

UF_6 CONVERSION PLANTS IN SELECTED COUNTRIES
Spector, 1984

Country	Safeguarded	Unsafeguarded
Argentina	None	Capacity presumed[1]
Brazil	Resende*	IPEN* IPEN
India	None	None
Iraq	None	None
Israel	None	None
Libya	None	None
Pakistan	None	Unnamed facility
South Africa	None	Valindaba

* Not yet operating

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[1] Safeguard status unknown

Source: Ibid.

FUEL CYCLE COMPONENTS IN SELECTED COUNTRIES — SUMMARY CHART

Spector, 1984

	Power Reactors	Research Reactors	Enrichment	Reprocessing	Heavy Water	Uranium Resources	Uranium Mines	Uranium Mills	UO_2 Pur.	Fuel Fab.	UF_6 Conv
Argentina	X	X	X	X	X	X	X	X	X	X	X
Brazil	X	X	X	X		X	X	X	X	X	X
India	X	X		X	X	X	X	X	X	X	
Iraq		X		X					X	X	
Israel		X	X	X	X	X	X	X	X	X	
Libya		X				X					
Pakistan	X	X	X	X	X	X	X	X	X	X	X
South Africa	X	X	X			X	X	X			X

Source: Ibid

A Speculative Comparison of the Nuclear Industrial Bases of Eight Non-Nuclear Weapon States in 1995

State	Estimated operational nuclear power (MW(e)) 1/ (1990)	Enrichment capacity	Breeder capacity	Reprocessing capacity	Commercial plutonium use	Heavy-water capacity	Nuclear capability index (subjective)	
							Test	Produce
Argentina	1,627	Minor	No	Notable 2/	Perhaps	Yes	4	2
Brazil	3,116	Some	No	Minor	No	No	3	0
Cuba	408	No	No	No	No	No	0	0
India	1,909	No	No	Some	Perhaps	Some	4	2
Israel	0	No	No	Some	No	No	4	2
Pakistan	125	Perhaps	No	Perhaps	No	No	3	1
South Africa	1,842	Some	No	No	No	No	3	2

Index rating scheme: 5=advanced, 4=strong, 3=moderate, 2=some, 1=slight, 0=none.

1/ Source: Nuclear Engineering International, May 1983, p. 2.

2/ A large pilot plant should be in operation by 1995.

Source: Congressional Research Service, An Assessment of the Proliferation Threat of Today and Tomorrow, September 24, 1984, p. 18. A report prepared for Senator William Proxmire by CRS Senior Specialist Warren H. Donnelly and released by Senator Proxmire's office on October 27, 1984.

LISTING OF 23 NON-NUCLEAR WEAPONS STATES BY NUCLEAR CAPABILITY IN 1995

States	Nuclear capability indices	
	Test	Produce
Argentina	4	2
India	4	2
Israel	4	2
Japan	4	2
Federal Republic of Germany	3	2
Belgium	2	0
Canada	2	1
Italy	2	0
Netherlands	2	0
Pakistan	2	1
South Africa	2	1
Spain	2	0
Sweden	2	0
Australia	1	0
Brazil	1	0
South Korea	1	0
Taiwan	1	0
Yugoslavia	1	0
Cuba	0	0
Egypt	0	0
Iran	0	0
Iraq	0	0
Libya	0	0

Source: Table 8, Part I.

The subjective index ratings are: 5 = advanced, 4 = strong, 3 = moderate, 2 = some, 1 = light and 0 = none.

Source: Ibid., p. 27.

NUCLEAR FACILITIES IN NON-NUCLEAR-WEAPONS STATES NOT SUBJECT TO IAEA SAFEGUARDS AS OF DECEMBER 31, 1984

Country	Facility	First year of operation
ARGENTINA		
	Uranium purification plant - Cordoba	1982 ?
	Uranium purification plant - Cordoba	?
	Heavy water plant - Atucha	1984 (est)
	Enrichment - Pilcaniyeu, expirimental	1983
	Fuel fabrication plant - Ezeiza	1982
	Reprocessing plant - Ezeiza	1986 (est)
	Research reactors	
	Cordoba	1965
	San Carolos de Bariloche	1982
	Planned	?
INDIA		
	Power Reactors	
	Madras I - Kalpakkam	1983
	Madras II - Kalpakkam	1985 (est)
	Narora I	1987 (est)
	Narora II	1987 (est)
	Kakrapar I	1991 (est)
	Kakrapar II	1992 (est)
	Heavy water plants	
	Nangal	1962
	Baroda	1977
	Tuticorin	1978
	Talcher	1979
	Kota	1984 (est)
	Thal	1986 (est)
	Manuguru	1987 (est)
	Reprocessing plants	
	Kalpakkam	1986 (est)
	Trombay	1966
	Tarapur	1982
	Research reactors	
	Zerlina	1961
	Apsara	1956
	R-5	1984 (est)
	Cirus	1963
	FBTR	1984 (est)
	Purnima	1972
	Fuel fabrication	
	Trombay	1960
	Hyderabad	1971
	Uranium purification - Hyderabad	?

NUCLEAR FACILITIES IN NON-NUCLEAR-WEAPONS STATES NOT SUBJECT TO IAEA SAFEGUARDS AS OF DECEMBER 31, 1984 (CONTINUED)

Country	Facility	First year of operation
ISRAEL		
	Uranium purification plant	?
	Heavy water plant - Rehovot	1954
	Reprocessing - Nahal Soreq	1960 (?)
	Enrichment, experimental	1974
	UF_6 conversion plant	1974 (?)
	Research reactor - Dimona	1963
	Reprocessing - Dimona	Probably after 1969
PAKISTAN		
	UF_6 conversion plant	1980 (?)
	Heavy water plants	
	Multan	1980 (?)
	Karachi	1976
	Uranium purification plant	1980
	Reprocessing plants	
	Pinstech	?
	Chashma	?
	Fuel fabrication plant - Chashma	1980
	Reprocessing plant - Islamabad	1984 (est)
	Enrichment plant	
	Kahuta	1984 (partial)
	Sihala	Prior to 1984 (presumed)
SOUTH AFRICA		
	UF_6 conversion plant - Valindaba	Prior to 1975
	Enrichment plant - Valindaba	1975

Source: Spector, Nuclear Proliferation Today, 1984; and SIPRI Yearbook, 1983.

PROLIFERATION STATUS OF SIX STATES THAT DO NOT ACCEPT FULL SCOPE SAFEGUARDS, 1984

Feature	Argentina	Brazil	India	Israel	Pakistan	South Africa
Nuclear Power Status						
Nuclear generating capacity in 1990 (MWe) 1/	400	676	804	0	125	0 2/
Enrichment capacity	Minor	Minor	None	None	Claimed	Substantial
Breeder use	No	No	No 3/	No	No	No
Reprocessing capacity	UC	None	Some	Presumed	UC	None
Commercial plutonium in use	Minor	None	Some	None	None	None
Heavy water capacity	UC	None	Some	None	None	None
Non-Proliferation commitments						
Limited Test Ban Treaty	Signed only	Ratified	Ratified	Signed only	Signed only	Acceded
Non-Proliferation Treaty	No	No	No	No	No	No
Treaty of Tlatelolco	Signed only	Ratified but not in effect	No	No	No	No
Member of Nuclear Suppliers Group	No	No	No	No	No	No
Status of cooperation under agreements for nuclear cooperation with the United States 4/	Inoperative	Inoperative	Inoperative	None	None	Inoperative
All facilities under IAEA safeguards	No	No	No	No	No	No

UC = Under Construction

1/ Source: Table 1, part 1.

2/ In 1984 South Africa began start up of one of its two 922 MWe units at Koeberg

3/ India, however, has a breeder development program aimed at construction of breeders to produce plutonium and uranium-233.

4/ U.S. nuclear cooperation has been stopped because these countries have yet to agree to non-proliferation conditions of the U.S. Nuclear Non-Proliferation Act of 1978. However, the agreements are deemed to remain in force for any U.S. nuclear item supplied before the cutoff.

Source: Ibid., p. 30.

PROLIFERATION PRESSURES AND CONSTRAINTS
(Hudson Institute, 1976)

PRESSURES FOR PROLIFERATION

Security

-Deterrence of a nuclear rival.
-Defense against invasion.
-Weapon of last resort.
-Nuclear intimidation of non-nuclear rival(s).
-Buttress to bargaining position.

Status or influence

-Quest for regional or international status.
-Demonstrate nation viability.
-Fashion.

Bureaucratic factors

-Strengthen military, scientific, and/or bureaucratic morale.
-Scientific-technological momentum.
-Pressures from military-industrial complex.
-Bureaucratic politics within governments and/or armed services.

Domestic politics

-Strengthen domestic morale.
-Diverts domestic attention.

CONSTRAINTS ON PROLIFERATION

-Cost
-Limited technological and industrial base
-Dependence upon foreign nuclear inputs
-Domestic public opposition
-Risk of unauthorized seizure of nuclear weapons
-Reaction of regional opponents
-Reaction of allies
-Reaction of other nations
-Problems of developing a credible nuclear strategy

Source: Lewis A. Dunn and Herman Kahn. Trends in Nuclear Proliferation, 1975-95. Croton-on-Hudson, New York: The Hudson Institute, May 15, 1976, Report HI-2336/3-RR.

PROLIFERATION PRESSURES FOR 23 NON-NUCLEAR WEAPONS STATES, 1984

State	Proliferation Pressures			
	Prestige	Internal political	Fear of neighbors	Response to a neighbors nuclear activities
Argentina	Yes	Unclear	No	Perhaps
Australia	No	No	Perhaps	No
Belgium	No	No	No	No
Brazil	Yes	No	No	Perhaps
Canada	No	No	No	No
Cuba	Yes	Yes	Yes	Perhaps
Egypt	Perhaps	No	Yes	Yes
F. R. Germany	No	No	Yes	Yes
India	Yes	Yes	Yes	Yes
Iran	Perhaps	No	Yes	Perhaps
Iraq	Perhaps	Yes	Yes	Perhaps
Israel	Perhaps	Yes	Yes	Yes
Italy	No	No	No	No
Japan	No	No	No	No
Libya	Yes	Yes	Yes	Yes
Netherlands	No	No	No	No
Pakistan	Yes	Yes	Yes	Yes
South Africa	Yes	Yes	Yes	No
South Korea	Perhaps	Perhaps	Perhaps	Yes
Spain	No	No	No	No
Sweden	No	No	No	No
Taiwan	Perhaps	Perhaps	Yes	Yes
Yugoslavia	Perhaps	Perhaps	Yes	Yes

Source: Congressional Research Service. An Assessment of The Proliferation Threat of Today and Tomorrow, September 24, 1984, p. 10. A report prepared for Senator William Proxmire by CRS Senior Specialist Warren H. Donnelly and Released by Senator Proxmire's Office on October 27, 1984.

NON-PROLIFERATION CONSTRAINTS FOR 23 NON-NUCLEAR WEAPONS STATES, 1984.

State	Limited Test Ban Treaty	Non-Proliferation Treaty	NPT type safeguards in effect	Latin American Nuclear Free Zone Treaty
Argentina	Signed only	No	No	Signed only
Australia	Ratified	Ratified	Yes	No
Belgium	Ratified	Ratified	Yes	No
Brazil	No	No	No	Yes 1/
Canada	Ratified	Ratified	Yes	No
Cuba	No	No	No	No
Egypt	Ratified	Ratified	Yes	No
F.R. Germany	Ratified	Ratified	Yes	No
India	Ratified	No	No	No
Iran	Ratified	Ratified	Yes	No
Iraq	Ratified	Ratified	Yes	No
Israel	Ratified	No	No	No
Italy	Ratified	Ratified	Yes	No
Japan	Ratified	Ratified	Yes	No
Libya	Ratified	Ratified	Yes	No
Netherlands	Ratified	Ratified	Yes	No
Pakistan	Signed only	No	No	No
South Africa	Ratified	No	No	No
South Korea	Ratified	Ratified	Yes	No
Spain	Ratified	No	No	No
Sweden	Ratified	Ratified	Yes	No
Taiwan	Ratified	Ratified	Yes	No
Yugoslavia	Ratified	Ratified	Yes	No

1/ Brazil has ratified the treaty but has not yet put it into effect.

Source: Ibid., p. 12.

SAFEGUARDS

CONTENTS

Page
Introduction 531
Summary information on IAEA safeguards (IAEA, 1982) 532
Quantities of safeguards significance (NASAP, 1980) 538
Selected IAEA inspection activities in 1981, 1982 and 1983 (IAEA, 1984) 539
Amounts of nuclear material under agency safeguards (IAEA, 1985) 540
Installations in non-nuclear-weapons states subject to safeguards or containing safeguarded material, 1983 to 1987 (IAEA, 1985) 541
Safeguards implementation in 1983 (IAEA press release) 542
Safeguards statement for 1983 (IAEA, excerpt from annual report for 1983) 543

SAFEGUARDS

Introduction

Since the advent of nuclear power, it has become widely accepted that because certain nuclear fuel materials can be used for either civil or military purposes, those used for commercial nuclear power should be subject to inspection and other measures to verify that they are not being diverted to the manufacture of nuclear weapons or other military uses. These measures are called safeguards. In the early days of U.S. nuclear cooperation with other nations, the United States Atomic Energy Commission sent its own inspectors to verify that U.S. nuclear exports were not misused. After the International Atomic Energy Agency was established in 1957, the United States began to press its nuclear partners to accept IAEA inspection instead of U.S. inspection. The Agency's safeguards responsibilities were greatly expanded in the 1970s by the Nuclear Non-Proliferation Treaty which requires non-nuclear-weapons members to accept IAEA safeguards on all of their peaceful nuclear facilities and materials.

The Agency has several safeguards systems. The system most commonly used is for states party to the NPT or the Treaty of Tlatelolco. An older system is used for IAEA states party to neither treaty. In 1985 the Agency expects to have 147 NPT/Tlatelolco-type agreements in effect, and 28 of the non-NPT type.

NPT and non-NPT safeguards systems differ in their scope and stated purposes. NPT safeguards are intended to detect diversion of significant quantities of nuclear material from peaceful nuclear activities to the manufacture of nuclear weapons or other nuclear explosive devices, or for purposes unknown. Non-NPT safeguards are intended to assure that nuclear assistance provided by the Agency or under its supervision or control is not used to further any military purpose. Coverage under the latter system is significantly broader, since it would include, for example, naval nuclear propulsion. NPT safeguards apply to all nuclear materials used for peaceful purposes in a nonnuclear-weapons state. Non-NPT safeguards apply only to specified nuclear materials and facilities, usually imported items or their derivatives.

SUMMARY INFORMATION ON IAEA SAFEGUARDS

WHAT ARE IAEA SAFEGUARDS?

IAEA Safeguards are a technical means of verifying that the nuclear activities of a country are consistent with international commitments of that country, for example, to verify that safeguarded material is not used to further any military purpose.

They serve a twofold role:

First, in the 114[*] non-nuclear-weapon states which have agreed by adherence to the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) not to acquire nuclear explosives, IAEA safeguards are designed:

- to assure the international community that each country is complying with its Treaty undertaking; and
- to deter any such country from secretly using safeguarded nuclear material to make a nuclear explosive. This deterrent effect is achieved by the expectation that IAEA safeguards will detect any such diversion.

In other countries (12 at present) IAEA safeguards are designed chiefly to assure supplying countries (as well as the international community) that nuclear plants or material they have supplied are used only for peaceful purposes.

IAEA applies its safeguards only to peaceful nuclear activities and they are not designed to deal with the problem of controlling or reducing the nuclear arsenals of the nuclear-weapon states.

HOW DID IAEA SAFEGUARDS DEVELOP?

Since the early 1950s when states began to trade in nuclear materials and equipment for peaceful purposes, it has been the practice for international agreements dealing with the use of nuclear energy to specify a set of "safeguards" to verify systematically that the state or states concerned would not use the relevant nuclear materials or equipment for purposes or in a manner proscribed by the agreement.

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[*] As of 30 June 1982.

The first IAEA safeguards agreement was signed in relation to a small Japanese research reactor in 1960. Since then revision and extension of the safeguards system has expanded the Agency's safeguards system to cover all types and sizes of nuclear plants. During the 1960s as the Agency gained experience in the application of safeguards it developed, extended and revised its safeguards system. This development culminated in the system finally approved by the Board of Governors in 1968 which covers all types of nuclear facilities. The system is described in the Agency document INFCIRC/66/Rev.2.

Safeguards are automatically applied to all assistance given by the IAEA which might otherwise be used for military purposes. A country may also voluntarily accept IAEA safeguards which may cover individual nuclear facilities or nuclear material, or may extend to the entire nuclear fuel cycle of the state. The first country to submit all its nuclear activities to IAEA safeguards was Mexico in 1968, in fulfilment of its obligations under the Tlatelolco Treaty, which seeks to create a nuclear-weapon-free zone in Latin America.

In 1970 the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) entered into force, requiring each non-nuclear-weapon state (NNWS) party to the Treaty to conclude safeguards agreements with the IAEA covering all nuclear materials in their peaceful nuclear activities.

To carry out the safeguards functions allocated to the IAEA by the NPT, it was necessary for the Agency to devise a safeguards approach appropriate for the entire fuel cycle of the countries that were expected to join the Treaty. Delegates from 48 Member States of the IAEA participated in the negotiation of the NPT approach, which was drawn up during 1970 and approved by the IAEA Board of Governors in the same year. (This NPT safeguards approach is set forth in IAEA document INFCIRC/153 corrected.)

HOW MUCH OF THE WORLD'S NUCLEAR ACTIVITY IS COVERED BY IAEA SAFEGUARDS?

While the number of states technically capable of producing nuclear material suitable for nuclear weapons is already large and likely to increase, approximately 98% of the nuclear activities in all NNWS (both party and non-party to the NPT) are presently under safeguards.

Apart from the three NWS party to the Treaty (UK, USSR and USA), up to now 114 NNWS have adhered to the NPT and have thus entered into an international legal commitment not to acquire nuclear weapons or other nuclear explosive devices in any manner whatsoever. Thirty-seven of these states have substantial nuclear activities and have concluded the required safeguards agreement with the IAEA. Twenty-two Latin American states have also ratified and brought into force the Treaty for the Prohibition of Nuclear Arms in Latin America (the "Tlatelolco Treaty"). All but two of these states are also parties to the NPT.

Voluntary offers were also made by two of the NWS (UK and USA) for the Agency to apply safeguards to all their civilian nuclear installations, except those related to national security. France, a nuclear-weapons state not party to the NPT, has offered to submit selected facilities of the nuclear fuel cycle to IAEA safeguards. All three agreements are now in force. At the Second UN Special Session Devoted to Disarmament in June 1982, the USSR also indicated its willingness to put under the control of the IAEA a part of its peaceful nuclear installations – nuclear power plants and research reactors.

There are 12 NNWS not party to the NPT operating nuclear facilities. In 8 of these states all substantial nuclear activities known to the Agency are covered by provisions of existing IAEA safeguards agreements. In the other four only some installations are under safeguards and there are other nuclear facilities in operation or under construction which are able to produce weapons-usable material but which still remain unsafeguarded.

HOW ARE SAFEGUARDS APPLIED?

The operator of a nuclear plant must keep accurate accounts of the movement of nuclear material into and out of his plant as well as through various plant processes. This is essential for safe and economical operation. Much of the IAEA's verification consists of checking and auditing these accounts. For instance, countries are required to report periodically to the IAEA Headquarters on every change in the quantities of nuclear material in their various nuclear plants. The IAEA checks, analyses and compares these reports both at Headquarters and during inspections. IAEA inspectors regularly visit the plants to check plant records for correctness and compare these records with the reports sent to the IAEA. They also verify, by measurements and other means whether the amounts of nuclear material actually in the plants, and the increases or decreases since the last inspection, agree with the amounts shown or calculated from records and reports. To make inspections more effective the IAEA is increasingly using safeguards instruments designed to be proof against tampering. These instruments survey and record any movements of nuclear material in the plant between each inspection – e.g. by automatic cameras that run for several months and take pictures at short intervals and by similarly programmed TV cameras and recorders. The IAEA also makes use of tamper-proof seals to seal off stores of nuclear material between inspections or to seal the cores of the reactors themselves (i.e. the fuel in the reactor).

CAN SAFEGUARDS PREVENT THE DEVELOPMENT OF NUCLEAR WEAPONS?

Safeguards are essentially a technical means of verifying the fulfilment of political obligations undertaken by states and given legal force in international agreements relating to the peaceful uses of nuclear energy. Today most of these obligations flow from the NPT and similar agreements. According to agreements of this type, the objectives of safeguards are: "the timely detection of diversion of significant quantities of nuclear material from peaceful nuclear activities to the manufacture of nuclear weapons or of other explosive devices or for purposes unknown, and deterrence of such diversion by the risk of early detection." The same concepts apply essentially today for non-NPT type agreements as well.

A related political objective of safeguards is to provide, through their application, assurance to the international community that states are complying with their non-proliferation and other "peaceful use" undertakings, and that any diversion would be promptly detected.

States conclude safeguards agreements voluntarily and the IAEA has no authority to apply safeguards unless the state concerned so requests (as it is obliged to do if it is a party to such a legal instrument as the NPT). In view of the voluntary nature of the acceptance of safeguards, it is reasonable to expect that the normal results of applying safeguards will be to confirm that there has in fact not been any diversion.

It should be clear that no international safeguards system can physically prevent diversion. The IAEA safeguards system, which is basically a verification measure, is designed solely to prove the absence of diversion and is not designed in a way that would enable it to physically prevent a government from diverting nuclear material to the production of nuclear weapons.

It should be remembered that the system is limited to the verification of the safeguarded nuclear activities of the states which have invited the IAEA to do so and is based on agreements with them. The IAEA's system is therefore limited to detecting diversion of safeguarded material or misuse of safeguarded plant, and then triggering international action. The IAEA cannot itself take direct preventive action in a state if it detects that nuclear material is no longer being used in accordance with safeguards undertakings. The IAEA Statute and safeguards agreements only specify a small number of limited and formal sanctions against the breach of a safeguards agreement. The IAEA must report the matter to the UN Security Council and the General Assembly. It may withdraw its assistance and suspend the privileges and rights of IAEA Membership.

HOW MUCH DO SAFEGUARDS COST?

Safeguards costs have been rising as more nuclear plants are verified by the IAEA. Their total costs in 1982 will be about $26 million and in 1983 about $31 million.

These $26 million pay the salaries and costs of 150 inspectors together with a research, development, information handling and supporting staff of a further 215 persons at IAEA Headquarters and the specialized safeguards instruments which the inspectors use in the field. The contribution that IAEA safeguards make to international security and peaceful nuclear trade and development represents exceptional value for money.

Source: International Safeguards Information. IAEA, August 1982.

QUANTITIES OF SAFEGUARDS SIGNIFICANCE
(NASAP 1980)

Material	Quantity of Safeguards Significance	Safeguards apply to:
	"Direct-Use" Material	
Plutonium	8 kg	Total element
Uranium-233	8 kg	Total isotope
Uranium enriched to 20% or more	25 kg	U-235 isotope
	"Indirect-Use" Material	
Uranium enriched to less than 20%	75 kg	U-235
Thorium	20 metric tons	Total element

* Including natural and depleted uranium.

Source: IAEA Safeguards Glossary, 1980. IAEA/SG/INF/1

Table 1: Selected IAEA inspection activities in 1981, 1982 and 1983

Number of:	1981	1982	1983
Inspections carried out	1 400	1 700	1 840
Inspection man-days spent	5 061	6 307	6 727
Nuclear installations inspected	475	460	520
Accounting reports received in accordance with [153]-requirements	7 795	8 744	8 844
Seals applied and subsequently verified	4 000	6 000	6 800
Samples analysed by destructive assay in the Agency's Safeguards Analytical Laboratory	890	870	1 150
New data entries into the Agency's computer	345 000	685 000	800 000

Source: Peter Tempus. Progress in safeguards; 1983 implementation. IAEA bulletin, September 1984, p. 8.

Amounts of nuclear material under Agency safeguards (excluding nuclear material to be safeguarded under agreements concluded pursuant to voluntary offers made by nuclear-weapon States) Status as of 31 December 1983 and forecast for 1985 and 1990

Table 24

Material	Amounts (tonnes)					
	1983		1985		1990	
	NPT and/or Tlatelolco agreements	INFCIRC/66-type agreements	NPT and/or Tlatelolco agreements	INFCIRC/66-type agreements	NPT and/or Tlatelolco agreements	INFCIRC/66-type agreements
Plutonium	83.8	15.9	120-125	20-22	260-285	40-50
Uranium enriched to 20% or more	10.8	0.2	10.8	0.2	10.8	0.2
Uranium enriched to less than 20%	16 500	2 010	21 000-23 000	2 700-3 000	32 000-40 000	5 000-6 300
Source material	26 685	1 315	28 000-31 000	1 500-1 700	37 000-46 000	2 [illegible]00-3 200

Source: IAEA Program for 1985 and 1986 and Budget for 1985, p. 106.

Installations in non-nuclear-weapon States subject to safeguards or containing safeguarded material

(1983 to 1987)

Table 23

Type of installation	1983		1984		1985		1986		1987	
	NPT and/or Tlatelolco agreements	INFCIRC/66-type agreements	NPT and/or Tlatelolco agreements	INFCIRC/66-type agreements	NPT and/or Tlatelolco agreements	INFCIRC/66-type agreements	NPT and/or Tlatelolco agreements	INFCIRC/66-type agreements	NPT and/or Tlatelolco agreements	INFCIRC/66-type agreements
Power reactors	131	26	136	26	147	28	159	30	164	32
Research reactors and critical assemblies	151	28	155	27	156	27	161	28	161	30
Conversion plants	5	2	5	3	5	2	5	3	5	3
Fuel fabrication plants	32	8	31	9	31	9	32	9	32	9
Reprocessing plants	4	3	4	3	4	2	4	2	4	2
Enrichment plants	4	0	4	0	5	0	6	0	6	0
Separate storage facilities	26	2	27	2	29	2	32	2	33	2
Other facilities (> 1 ekg)	45	1	45	1	45	1	45	1	45	1
Other locations (< 1 ekg)	398	27	389	27	390	27	389	27	389	27
Non-nuclear installations	6	1	8	1	9	1	9	1	9	1
TOTAL	786	95	806	97	831	99	843	103	849	105

Source: IAEA Program for 1985 and 1986 and Budget for 1985, p. 105

IAEA

PR 84/14
FOR IMMEDIATE RELEASE

[illegible]
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PRESS RELEASE

[illegible]

SAFEGUARDS IMPLEMENTATION IN 1983

Vienna, 8 June 1984.-- The Secretariat of the International Atomic Energy Agency (IAEA) detected no anomaly during 1983 which would indicate the diversion of a significant amount of safeguarded nuclear material, or the misuse of facilities or equipment subject to safeguards, for the manufacture of any nuclear weapon or for any other military purpose, or for the manufacture of any other nuclear explosive device, or for purposes unknown.

This conclusion is contained in the IAEA Secretariat's annual "Safeguards Implementation Report" to its Board of Governors, which considered it at its meeting in Vienna this week. The purpose of IAEA safeguards is to provide confidence that nuclear programmes and nuclear installations submitted to them are not misused for military purposes.

The Agency reports that almost 1840 (1700 in 1982) inspections were carried out during the year at about 520 (500) nuclear installations in 50 (46) non-nuclear-weapon States and three (three) nuclear-weapon States. More than 230 (190) automatic photo and television surveillance systems operated in the field, and 6600 (6000) seals applied to nuclear material were detached and subsequently verified at Headquarters. More than 1150 (870) plutonium and uranium samples were analysed, with about 2900 (1870) analytical results being reported. Accounting and other safeguards data comprising 900 000 (655 000) data entries were processed and stored in the Agency's computer.

The report says the sensitivity of inspection and evaluation activities may be illustrated by the fact that about 420 (406), mostly minor, discrepancies or anomalies were found. All cases but one were explained satisfactorily upon subsequent appraisal or investigation; one case is still being investigated.

By the end of 1983, a total of 139 safeguards agreements were in force with 92 States (90 in 1982). Safeguards were actually applied in 39 non-nuclear-weapon States under agreements concluded pursuant to the Treaty on the Non-Proliferation of Nuclear Weapons (the NPT), or to the NPT and the Tlatelolco Treaty, and in one non-nuclear-weapon State pursuant to the Tlatelolco Treaty. In addition, safeguards were applied in three nuclear-weapon States pursuant either to voluntary offer agreements, or to safeguards agreements connected with the transfer of nuclear material or equipment. Forty other safeguards agreements were in force with the ten non-nuclear-weapon States not party to either NPT or the Tlatelolco Treaty. In six of those States, as in nuclear-weapon States, facilities of significance for safeguards but not safeguarded by the IAEA were known to be in operation or under construction.

SAFEGUARDS STATEMENT FOR 1983

(Excerpt from 1983 IAEA Annual Report)

305. In 1983, as in previous years, the Secretariat, in carrying out the safeguards obligations of the Agency, did not detect any anomaly which would indicate the diversion of a significant amount of safeguarded nuclear material - or the misuse of facilities or equipment subject to safeguards under certain agreements - for the manufacture of any nuclear weapon, or for any other military purpose, or for the manufacture of any other nuclear explosive device, or for purposes unknown[10]. With the exception of two cases where the Agency was unable to draw conclusions for part of the year[11], it is considered reasonable to conclude that nuclear material under Agency' safeguards in 1983 remained in peaceful nuclear activities or was otherwise adequately accounted for. This statement should be seen in the light of the following observations:

(a) Extensive safegurds activities in 1983 resulted in almost 1840 (1700 in 1982) inspections carried out at about 520 (500) nuclear installations in 50 (46) non-nuclear-weapon States and 3 (three) nuclear-weapon States. In 26% (23%) of inspections nuclear material was verified by non-destructive assay (NDA). More than 230 (190) automatic photo and television surveillance systems operated in the field, and 6600 (6000) seals applied to nuclear material were detached and subsequently verified at Headquarters. More than 1150 (870) plutonium and uranium samples were analysed, with about 2980 (1870) analytical results being reported. Accounting and other safeguards data comprising 800 000 (655 000) data entries were processed and stored in the Agency's computer;

(b) The sensitivity of inspection and evaluation activities may be illustrated by the fact that about 420 (406), mostly minor, discrepancies or anomalies were found. All cases but one were satisfactorily explained upon subsequent appraisal or investigation; one case is still being investigated;

(c) The level of assurance associated with the Secretariat's findings for a particular installation or State depends - inter alia - on the content of the safeguards agreement concluded with the State in question, on the funds, manpower and equipment available to the Agency, and on the co-operation of the State and of the facility operators in it;

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[10] In the case of voluntary-offer agreements with nuclear-weapon (NW) States nuclear material to which safeguards were applied was not withdrawn from safeguards except in conformity with these agreements.

[11] In these two cases, relating to two nuclear power plants, additional technical safeguards measures were put into effect during the first half of 1983. The measures taken enabled the Agency thereafter to perform effective verification. Full use of the agreed additional equipment at these installations will further improve confidence in safeguards.

(d) The findings of the Safeguards Implementation Report (SIR) refer for each facility to the latest available State report, Agency inspection, analysis etc. relating to that facility.

Safeguards coverage

306. By the end of 1983, a total of 159 safeguards agreements were in force with 92 States (90 in 1982).

307. During 1983, safeguards agreements concluded pursuant to NPT with the Ivory Coast and Papua New Guinea entered into force, bringing the total number of non-nuclear-weapon States with agreements in force pursuant to NPT and/or the Tlatelolco Treaty to 77.

308. Of the 118 non-nuclear-weapon States party to NPT, 41 have not yet complied with their obligations under Article III.4 of the Treaty regarding the conclusion of the relevant safeguards agreement with the Agency[12]. With the exception of Viet Nam, with which a safeguards agreement pursuant to NPT is under negotiation, none of these States has, as far as the Agency is aware, significant nuclear activities.

309. During 1983, safeguards were actually applied in 39 non-nuclear-weapon States under agreements concluded pursuant to NPT or to NPT and the Tlatelolco Treaty and in one non-nuclear-weapon State pursuant to the Tlatelolco Treaty. In addition, safeguards were applied in three nuclear-weapon States pursuant either to voluntary-offer agreements or to safeguards transfer agreements.

310. Forty safeguards agreements based on INFCIRC/66/Rev.2 were in force with the following ten non-nuclear-weapon States not party to either NPT or the Tlatelolco Treaty: Argentina, Brazil, Chile, Cuba, the Democratic People's Republic of Korea, India, Israel, Pakistan, South Africa and Spain. Safeguards were actually applied pursuant to these agreements in nine of the ten States and also in Viet Nam (see para. 308 above).[13]

311. In six of these States, as in nuclear-weapon States, unsafeguarded facilities of significance for safeguards were known to be in operation or under construction.[14]

312. At the end of 1983, there were 455 facilities under safeguards or containing safeguarded material in non-nuclear-weapon States. In addition, there were 425 locations outside facilities containing small amounts of safeguarded material and one non-nuclear installation. Also, there were nine facilities in nuclear-weapon States where safeguards were being applied (pursuant either to safeguards transfer agreements or to voluntary-offer agreements).

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[12] A safeguards agreement pursuant to NPT with Nauru entered into force on 13 April 1984.

[13] The Agency also applies safeguards to nuclear facilities in Taiwan, China.

[14] In one of the six States, Agency safeguards cover all nuclear facilities except a fuel fabrication facility which is under construction. It is expected that, when operational, this facility will handle only safeguarded nuclear material and therefore be covered by Agency safeguards.

313. In 1983, the nuclear material under Agency safeguards, excluding that covered by the voluntary-offer agreements with nuclear-weapon States, amounted to 6.8 t (6 t in 1982) of separated plutonium, 11 t (10 t) of high-enriched uranium (HEU), 92.9 t (83 t) of plutonium contained in irradiated fuel, 18 590 t (16 782 t) of low-enriched uranium (LEU) and 28 000 t (25 000 t) of source material. Non-nuclear material under Agency safeguards included 1307 t of heavy water.

Major activities during 1983

Safeguards implementation

314. Progress was achieved in several areas thanks to an increase in available manpower, improvements in implementation, the use of more sophisticated instruments, better co-ordination in the field and at Headquarters, and better co-operation between States and the Agency. As a result, further to the achievements noted above in para. 305(a) and (b),

- inspection effort (including the application and evaluation of nuclear material accountancy and the application of containment/ surveillance (C/S) measures), the number of measurements and the scope of data processing increased considerably,

- the number of major facilities at which inspection goals were fully attained in 1983 for the whole facility increased by about 9% compared with 1982,

- the number of inspections where NDA measurements were performed was more than 20% higher in 1983 than in 1982,

- simultaneous physical inventory verification was performed in one State, covering all major facilities involved in the natural uranium fuel cycle in that State.

Safeguards information treatment

315. A high level of timeliness, quality and user-orientation was maintained in the Agency's treatment of State reports, inspection data and management data. Computerized data processing was routinely used for inspection planning and for inspection reporting, as well as for safeguards evaluation purposes.

316. By the end of 1983, the IAEA Safeguards Information System (ISIS) data base contained approximately 2 900 000 records, compared with about two million at the end of 1982. During the year:

- Software and quality control procedures for the computerized inspection report (CIR) sub-system were developed, tested and used with reports relating to item facilities; preparatory work was done on extending this sub-system to cover reports relating to bulk-handling facilities (BHFs);

- The use of ISIS was further decentralized through the assignment of responsibility for inspection data entry and inspection report checking and production to the Divisions of Operations, under conditions of strict data security;

- In one of the Divisions of Operations, a pilot project was initiated involving the use of two PC-350 microcomputers (one in the field and one at Headquarters), the aim being to increase the quality, quantity and reliability of information exchanged between field locations and Headquarters. Transmissions of telex-type messages from computer to computer were achieved using a commercial teleprocessing network. Work also started on the use of similar technology in linking Headquarters with another field location;

- Advisory services were provided to several countries in the process of computerizing their reporting procedures;

- The Agency continued to seek the full implementation of recommendations made by a group of consultants from Member States concerning reporting procedures, the intention being to provide for greater efficiency and effectiveness in the processing of data on nuclear material in international transit;

- An internal review started of the experience gained with ISIS during its first three years of operation, the aim being to establish short-term and long-term plans for the further development of ISIS;

- A workshop seminar on safeguards data processing was attended by participants from 20 countries and one regional organization.

Safeguards development and technical support

317. During 1983 there was a further increase in the field use of new safeguards equipment and a commensurate increase in the programme for procurement, documentation, maintenance, repair and distribution. Routine services included the provision and verification of seals, photo processing, the analysis of gamma spectrometric data, and arrangements for shipping and for the destructive analysis of inspection samples.

- The first five Surveillance Television and Recording (STAR) systems were installed in November and December, following an extensive assessment of their reliability.

- A computerized system for safeguards equipment inventory control was introduced and initial steps taken for extending the system so as to provide for maintenance management.

318. An instrument performance monitoring and control programme was implemented, the aim being to achieve better performance of instruments under normal field conditions.

319. Field tests of a number of instrument systems developed under Member States' programmes in support of Agency safeguards were conducted:

- a portable analysis unit for plutonium isotopic measurements,

- equipment (ION-1) for the simultaneous measurement of gamma radiation and neutrons from irradiated fuel assemblies,

- special detector heads for high-level neutron coincidence counters (HLNCCs) for carrying out measurements of plutonium in specific chemical and physical forms,
- a calorimeter for the assay of plutonium in bulk form (to be used in the calibration of HLNCCs),
- tracer techniques for calibrating the volumes of accountability tanks, and
- modified Cherenkov glow monitoring devices capable of operating with ambient lighting.

Four bundle counters were installed in two on-load refuelled reactors and put into use.

320. The following instruments and techniques were tested and evaluated at Headquarters:

- two commercially available battery-powered multichannel analyser units controlled by built-in microprocessors,
- reliable film surveillance cameras with increased film capacity, extended light range, and date-time annotation, and
- an improved transportable closed-circuit television system.

321. In the designing of specific safeguards approaches:

- special attention was paid to developing and improving safeguards approaches for sensitive facilities such as reprocessing plants, HEU and MOX fuel fabrication plants and ultracentrifuge uranium enrichment plants. Progress was made in studying the use of advanced safeguards methods such as near-real-time material accountancy at reprocessing plants. Following the recommendation resulting from the Hexapartite Safeguards Project, preparatory work was done on including the "limited-frequency unannounced-access" concept in the safeguards approach for specific enrichment plants,
- the development of safeguards approaches for heavy-water production plants continued.

322. Guidelines for designing nuclear facilities in such a way as to make the application of safeguards easier were developed for four types of nuclear facilities; work on recommendations for other facility types continued.

Safeguards evaluation

323. In the area of data evaluation:

- services were provided to the Divisions of Operations, particularly in connection with the analysis of samples at the Safeguards Analytical Laboratory (SAL) and through the network of analytical laboratories, with inspection data from fuel fabrication plants and reprocessing plants, with the calibration of accountability tanks, and with the preparation and characterisation of NDA reference materials,

- work was completed on two manuals, for internal use, describing computer procedures for the evaluation of inspection data from fuel fabrication plants and reprocessing plants,

- data evaluation services were provided to the Division of Development and Technical Support in connection with the testing and calibration of NDA equipment, with the automatic transfer of data from instruments to computers in the field and at Headquarters, with the testing of isotope correlation methods for the verification of reprocessing plant inputs, and with the co-ordination of several Member States' support activities relating to data evaluation methods, and

- evaluation procedures and criteria were reviewed and further developed with regard to inspection goal attainment, sampling plans, inspection reports and inspection statements.

324. Further improvements were made in the review and evaluation of inspection reports and of inspection statements to States pursuant to safeguards agreements based on INFCIRC/153 (Corrected) and on INFCIRC/66/Rev.2.

- 1315 inspection reports and 1402 inspection statements were reviewed using computer-assisted review procedures.

- Quality assurance activities relating to inspection report data on seals and surveillance were extended so as to cover a larger number of inspections.

- Detailed procedures for the internal review of safeguards implementation were worked out and applied in specific cases.

In addition, an algorithm was developed to perform evaluations for the Safeguards Implementation Report (SIR) using computerized inspection report data relating to item facilities.

Support by outside expert groups

325. A number of advisory group and similar meetings took place in 1983.

- The Standing Advisory Group on Safeguards Implementation (SAGSI) held two series of meetings.

- An advisory group considered questions relating to the non-destructive determination of the isotopic contents of plutonium samples.

- An advisory group considered aspects of designing nuclear facilities in such a way as to facilitate the implementation of Agency safeguards.

- An advisory group considered questions connected with evaluating the quality of safeguards analytical measurements.

- Consultant groups considered (1) detailed recommendations for States' systems of accounting for and control of nuclear material (SSACs) at the facility level; (2) safeguards effectiveness assessment methodologies; and (3) closed-circuit television equipment for surveillance purposes.

Co-operation between States and the Agency

326. Continuing co-operation between States and the Agency is exemplified by the following:

- A training course on SSACs was attended by participants from 13 countries;

- Substantial contributions to the safeguards development programme were made by national programmes in support of Agency safeguards. Australia, Belgium, Canada, France, the Federal Republic of Germany, Japan, the Soviet Union, the United Kingdom, the United States of America and the European Community provided support in the framework of formalised support programmes, while other Member States contributed through arrangements such as research and development agreements, contracts and test programmes. A first "support programme co-ordinators' meeting" was held with a view to achieving better co-ordination;

- Committees and other regular forms of contact, including working arrangements with facility operators, continued to make a significant contribution to the solution of problems relating to safeguards implementation.

The Agency's resources

Manpower

327. In 1983 there was an increase of 4.5% in the available inspector (including inspection assistant) man-years; this resulted in an increase of 1.9% in the available man-years of designated inspectors (and inspection assistants) for carrying out inspections at facilities. A total of 6727 man-days of inspection at facilities was produced, representing an increase of 6.7% compared to 1982.

328. Training for new inspectors included two inspection exercises at facilities in Member States. In addition, advanced courses in NDA, inspection procedures and computer data base utilization were provided at Headquarters and in four Member States. One refresher course for experienced inspectors was held, but more emphasis on refresher courses is needed, particularly in the fields of NDA measurements and computer-assisted inspection reporting. The trainee programme for junior professionals began, the first phase being an introductory course at Headquarters.

329. The final stage in the reorganization of the Department of Safeguards was completed, with the establishment of a third Division of Operations and two supporting Divisions.

Equipment

330. The budgetary resources for equipment increased by 150% (from $1.6 million in 1982 to $4 million in 1983). This permitted the acquisition of advanced safeguards devices, including HLNCCs with special detector heads, advanced high-resolution gamma spectrometer multichannel analyser systems and advanced closed-circuit television surveillance systems. These devices will be subjected to thorough field testing and evaluation programmes in preparation for their routine use. The benefits resulting from their acquisition, mainly increased safeguards effectiveness, will therefore become apparent only in a few years' time.

Table 2

States having significant nuclear activities
(at the end of the year indicated)

	Number of States		
	1981	1982	1983
NNW States with safeguards applied under NPT and/or Tlatelolco agreements	36	39	40
NNW States with safeguards applied under INFCIRC/66/Rev.2 agreements[a]	12	11	11
Sub-total (NNW States in which safeguards measures were implemented)	48	50	51
NNW States without safeguards agreement in force	1	0	0
Total number of NNW States with significant nuclear activities	49	50	51
NW States party to NPT	3	3	3
Other NW States	2	2	2
Total number of States with significant nuclear activities	54	55	56

[a] Some States with INFCIRC/66/Rev.2 agreements which have not yet been suspended, although NPT and/or Tlatelolco agreements have entered into force, are listed as falling under NPT and/or Tlatelolco agreements only.

Table 3

Approximate quantities of material subject to Agency safeguards except that covered by voluntary-offer agreements with NW States at the end of 1983

Type of material	Quantity of material (t)		Quantity in SQ
	in NNW States	in NW States[a]	
__Nuclear material__			
Plutonium[b] contained in irradiated fuel	85.8	7.1	11 600
Seperated plutonium	5.3	1.5	850
HEU (equal to or greater than 20% uranium-235)	11.0	0	260
LEU (less than 20% uranium-235)	17 600	990	5 820
Source material[c] (natural or depleted uranium and thorium)	28 000	0	2 270
__Total significant quantity__			20 800
__Non-nuclear material[d]__			
Heavy water	1 307	0	-[e]

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[a] Material in facilities in NW States subject to safeguards under safeguards transfer agreements.

[b] The quantity includes an estimated 39.7 t (4970 SQ) of plutonium in irradiated fuel, which is not reported to the Agency under the reporting procedures agreed to (the non-reported plutonium is contained in irradiated fuel assemblies to which item accountancy and C/S measures are applied).

[c] This table does not include material within the terms of sub-paragraphs 34(a) and (b) of INFCIRC/153 (Corrected) - in essence, yellow cake.

[d] Non-nuclear material subject to Agency safeguards under INFCIRC/66/Rev.2-type agreements.

[e] "Quantity in SQ" does not apply to non-nuclear material.

Table 4

Installations in NNW States under safeguards or containing safeguarded material at the end of 1983

Installation category	Number of installations		
	INFCIRC/153a/	INFCIRC/66/Rev.2	Totalb/
A. Power reactors	121	26	147 (143)
B. Research reactors and critical assemblies	151	26	177 (177)
C. Conversion plants	5	2	7 (6)
D. Fuel fabrication plants	32	8	40 (39)
E. Reprocessing plants	4	2	6 (6)
F. Enrichment plants	4	0	4 (4)
G. Separate storage facilities	26	2	28 (23)
H. Other facilities	45	1	46 (42)
I. Other locations	398	27	425 (404)
J. Non-nuclear installations	0	1	1 (0)
Totals	786	95	881 (844)

a/ Covering safeguards agreements pursuant to NPT and/or Tlatelolco Treaty.

b/ Numbers for 1982 are indicated in parentheses for comparison.

Source: International Atomic Energy Agency. The annual report for 1983, pp. 59-69

THE NON-PROLIFERATION TREATY REVIEW CONFERENCE

CONTENTS

Page

Introduction 557

Final declaration of the 1975 review conference, May 30, 1985.......... 558

Unofficial paper distributed at the final session of the 1980 conference. 569

Nuclear Non-Proliferation Treaty Review Conference of 1985 (CRS Issue Brief IB85009).......... 577

THE NON-PROLIFERATION TREATY REVIEW CONFERENCE

INTRODUCTION

In September 1985, the third international review conference for the treaty on the Non-Proliferation of Nuclear Weapons (NPT) will be held in Geneva. The NPT is the keystone of the structure of international commitments, agreements and understandings that is intended to reduce the risks that increasing use of nuclear power will enable more nations to readily acquire nuclear weapons. Article VII provided for a conference to be held 5 years after the treaty entered into force to review its operation and assure that the purposes stated in the preamble and the provisions of the treaty were being carried out. Further conferences could be convened at intervals of 5 years if a majority of the parties so proposed. The review conferences in 1975 and 1980 were marked by division between the nuclear weapons states and other industrialized nations which wanted to discuss technical nonproliferation questions, and Third World nations which wanted to discuss restrictions on the supply of nuclear technology and the failure, in their view, of the weapons states to live up to their disarmament commitments under article VI of the treaty. These disputes are likely to reappear at the 1985 review conference. However, at this time it seems unlikely that any nations will withdraw from the treaty or propose its termination.

FINAL DECLARATION OF THE REVIEW CONFERENCE BY THE PARTIES TO THE TREATY ON THE NON-PROLIFERATION OF NUCLEAR WEAPONS 1/

PREAMBLE

The States Party to the Treaty on the Non-Proliferation of Nuclear Weapons which met in Geneva in May 1975, in accordance with the Treaty, to review the operation of the Treaty with a view to assuring that the purposes of the Preamble and the provisions of the Treaty are being realized,

Recognizing the continuing importance of the objectives of the Treaty,

Affirming the belief that universal adherence to the Treaty would greatly strengthen international peace and enhance the security of all States,

Firmly convinced that, in order to achieve this aim, it is essential to maintain, in the implementation of the Treaty, an acceptable balance of mutual responsibilities and obligations of all States Party to the Treaty, nuclear-weapon and non-nuclear-weapon States,

Recognizing that the danger of nuclear warfare remains a grave threat to the survival of mankind,

Convinced that the prevention of any further proliferation of nuclear weapons or other nuclear explosive devices remains a vital element in efforts to avert nuclear warfare, and that the promotion of this objective will be furthered by more rapid progress towards the cessation of the nuclear arms race and the limitation and reduction of existing nuclear weapons, with a view to the eventual elimination from national arsenals of nuclear weapons, pursuant to a Treaty on general and complete disarmament under strict and effective international control,

Recalling the determination expressed by the Parties to seek to achieve the discontinuance of all test explosions of nuclear weapons for all time,

Considering that the trend towards détente in relations between States provides a favourable climate within which more significant progress should be possible towards the cessation of the nuclear arms race,

Noting the important role which nuclear energy can, particularly in changing economic circumstances, play in power production and in contributing to the progressive elimination of the economic and technological gap between developing and developed States,

Recognizing that the accelerated spread and development of peaceful applications of nuclear energy will, in the absence of effective safeguards, contribute to further proliferation of nuclear explosive capability,

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1/ U.S. Department of State. Department of State Bulletin, June 30, 1975.

Recognizing the continuing necessity of full co-operation in the application and improvement of International Atomic Energy Agency (IAEA) safeguards on peaceful nuclear activities,

Recalling that all Parties to the Treaty are entitled to participate in the fullest possible exchange of scientific information for, and to contribute alone or in co-operation with other States to, the further development of the applications of atomic energy for peaceful purposes,

Reaffirming the principle that the benefits of peaceful applications of nuclear technology, including any technological by-products which may be derived by nuclear-weapon States from the development of nuclear explosive devices, should be available for peaceful purposes to all Parties to the Treaty, and

Recognizing that all States Parties have a duty to strive for the adoption of tangible and effective measures to attain the objectives of the Treaty,

Declare as follows:

PURPOSES

The States Party to the Treaty reaffirm their strong common interest in averting the further proliferation of nuclear weapons. They reaffirm their strong support for the Treaty, their continued dedication to its principles and objectives, and their commitment to implement fully and more effectively its provisions.

They reaffirm the vital role of the Treaty in international efforts

—to avert further proliferation of nuclear weapons

—to achieve the cessation of the nuclear arms race and to undertake effective measures in the direction of nuclear disarmament, and

—to promote co-operation in the peaceful uses of nuclear energy under adequate safeguards.

REVIEW OF ARTICLES I AND II

The review undertaken by the Conference confirms that the obligations undertaken under Articles I and II of the Treaty have been faithfully observed by all Parties. The Conference is convinced that the continued strict observance of these Articles remains central to the shared objective of averting the further proliferation of nuclear weapons.

REVIEW OF ARTICLE III

The Conference notes that the verification activities of the IAEA under Article III, 1, of the Treaty respect the sovereign rights of States and do not hamper the economic, scientific or technological development of the Parties to the Treaty or international co-operation in peaceful nuclear activities. It urges that this situation be maintained. The Conference attaches considerable importance to the continued application of safeguards under Article III, 1, on a non-discriminatory basis, for the equal benefit of all States Party to the Treaty.

The Conference notes the importance of systems of accounting for and control of nuclear material, from the standpoints both of the responsibilities of States Party to the Treaty and of co-operation with the IAEA in order to facilitate the implementation of the safeguards provided for in Article III, 1. The Conference expresses the hope that all States having peaceful nuclear activities will establish and maintain effective accounting and control systems and welcomes the readiness of the IAEA to assist States in so doing.

The Conference expresses its strong support for effective IAEA safeguards. In this context it recommends that intensified efforts be made towards the standardization and the universality of application of IAEA safeguards, while ensuring that safeguards agreements with non-nuclear-weapon States not Party to the Treaty are of adequate duration, preclude diversion to any nuclear explosive devices and contain appropriate provisions for the continuance of the application of safeguards upon re-export.

The Conference recommends that more attention and fuller support be given to the improvement of safeguards techniques, instrumentation, data-handling and implementation in order, among other things, to ensure optimum cost-effectiveness. It notes with satisfaction the establishment by the Director General of the IAEA of a standing advisory group on safeguards implementation.

The Conference emphasizes the necessity for the States Party to the Treaty that have not yet done so to conclude as soon as possible safeguards agreements with the IAEA.

With regard to the implementation of Article III, 2 of the Treaty, the Conference notes that a number of States suppliers of nuclear material or equipment have adopted certain minimum, standard requirements for IAEA safeguards in connexion with their exports of certain such items to non-nuclear-weapon States not Party to the Treaty (IAEA document INFCIRC/209 and Addenda). The Conference attaches particular importance to the condition, established by those States, of an undertaking of non-diversion to nuclear weapons or other nuclear explosive devices, as included in the said requirements.

The Conference urges that:

(a) in all achievable ways, common export requirements relating to safeguards be strengthened, in particular by extending the application of safeguards to all peaceful nuclear activities in importing States not Party to the Treaty;

(b) such common requirements be accorded the widest possible measure of acceptance among all suppliers and recipients;

(c) all Parties to the Treaty should actively pursue their efforts to these ends.

The Conference takes note of:

(a) the considered view of many Parties to the Treaty that the safeguards required under Article III, 2 should extend to all peaceful nuclear activities in importing States;

(b) (i) the suggestion that it is desirable to arrange for common safeguards requirements in respect of nuclear material processed, used or produced by the use of scientific and technological information transferred in tangible form to non-nuclear-weapon States not Party to the Treaty;

(ii) the hope that this aspect of safeguards could be further examined.

The Conference recommends that, during the review of the arrangements relating to the financing of safeguards in the IAEA which is to be undertaken by its Board of Governors at an appropriate time after 1975, the less favourable financial situation of the developing countries be fully taken into account. It recommends further that, on that occasion, the Parties to the Treaty concerned seek measures that would restrict within appropriate limits the respective shares of developing countries in safeguards costs.

The Conference attaches considerable importance, so far as safeguards inspectors are concerned, to adherence by the IAEA to Article VII.D of its Statute, prescribing, among other things, that "due regard shall be paid . . . to the importance of recruiting the staff on as wide a geographical basis as possible"; it also recommends that safeguards training be made available to personnel from all geographic regions.

The Conference, convinced that nuclear materials should be effectively protected at all times, urges that action be pursued to elaborate further, within the IAEA, concrete recommendations for the physical protection of nuclear material in use, storage and transit, including principles relating to the responsibility of States, with a view to ensuring a uniform, minimum level of effective protection for such material.

It calls upon all States engaging in peaceful nuclear activities (i) to enter into such international agreements and arrangements as may be necessary to ensure such protection; and (ii) in the framework of their respective physical protection systems, to give the earliest possible effective application to the IAEA's recommendations.

Review of Article IV

The Conference reaffirms, in the *framework* of Article IV, 1, that nothing in the Treaty shall be interpreted as affecting, and notes with satisfaction that nothing in the Treaty has been identified as affecting, the inalienable right of all the Parties to the Treaty to develop research, production and use of nuclear energy for peaceful purposes without discrimination and in conformity with Articles I and II of the Treaty.

The Conference reaffirms, in the *framework* of Article IV, 2, the undertaking by all Parties to the Treaty to facilitate the fullest possible exchange of equipment, materials and scientific and technological information for the peaceful uses of nuclear energy and the right of all Parties to the Treaty to participate in such exchange and welcomes the efforts made towards that end. Noting that the Treaty constitutes a favourable *framework* for broadening international co-operation in the peaceful uses of nuclear energy, the Conference is convinced that on this basis, and in conformity with the Treaty, further efforts should be made to ensure that the benefits of peaceful applications of nuclear technology should be available to all Parties to the Treaty.

The Conference recognizes that there continues to be a need for the fullest possible exchange of nuclear materials, equipment and technology, including up-to-date developments, consistent with the objectives and safeguards requirements of the Treaty. The Conference reaffirms the undertaking of the Parties to the Treaty in a position to do so to co-operate in contributing, alone or together with other States or international organizations, to the further development of the applications of nuclear energy for peaceful purposes, especially in the territories of non-nuclear-weapon States Party to the Treaty, with due consideration for the needs of the developing areas of the world. Recognizing, in the context of Article IV, 2, those growing needs of developing States the Conference considers it necessary to continue and increase assistance to them in this field bilaterally and through such multilateral channels as the IAEA and the United Nations Development Programme.

The Conference is of the view that, in order to implement as fully as possible Article IV of the Treaty, developed States Party to the Treaty should consider taking measures, making contributions and establishing programmes, as soon as possible, for the provision of special assistance in the peaceful uses of nuclear energy for developing States Party to the Treaty.

The Conference recommends that, in reaching decisions on the provision of equipment, materials, services and scientific and technological information for the peaceful uses of nuclear energy, on concessional and other appropriate financial arrangements and on the furnishing of technical assistance in the nuclear field, including co-operation related to the continuous operation of peaceful nuclear facilities, States Party to the Treaty should give weight to adherence to the Treaty by recipient States. The Conference recommends, in this connexion, that any special measures of co-operation to meet the growing needs of developing States Party to the Treaty might include increased and supplemental voluntary aid provided bilaterally or through multilateral channels such as the IAEA's facilities for administering funds-in-trust and gifts-in-kind.

The Conference further recommends that States Party to the Treaty in a position to do so, meet, to the fullest extent possible, "technically sound" requests for technical assistance, submitted to the IAEA by developing States Party to the Treaty, which the IAEA is unable to finance from its own resources, as well as such "technically sound" requests as may be made by developing States Party to the Treaty which are not Members of the IAEA.

The Conference recognizes that regional or multinational nuclear fuel cycle centres may be an advantageous way to satisfy, safely and economically, the needs of many States in the course of initiating or expanding nuclear power programmes, while at the same time facilitating physical protection and the application of IAEA safeguards, and contributing to the goals of the Treaty.

The Conference welcomes the IAEA's studies in this area, and recommends that they be continued as expeditiously as possible. It considers that such studies should include, among other aspects, identification of the complex practical and organisational difficulties which will need to be dealt with in connexion with such projects.

The Conference urges all Parties to the Treaty in a position to do so to co-operate in these studies, particularly by providing to the IAEA where possible economic data concerning construction and operation of facilities such as chemical reprocessing plants, plutonium fuel fabrication plants, waste management installations, and longer-term spent fuel storage, and by assistance to the IAEA to enable it to undertake feasibility studies concerning the establishment of regional nuclear fuel cycle centres in specific geographic regions.

The Conference hopes that, if these studies lead to positive findings, and if the establishment of regional or multinational nuclear fuel cycle centres is undertaken, Parties to the Treaty in a position to do so, will co-operate in, and provide assistance for, the elaboration and realization of such projects.

REVIEW OF ARTICLE V

The Conference reaffirms the obligation of Parties to the Treaty to take appropriate measures to ensure that potential benefits from any peaceful applications of nuclear explosions are made available to non-nuclear-weapon States Party to the Treaty in full accordance with the provisions of Article V and other applicable international obligations. In this connection, the Conference also reaffirms that such services should be provided to non-nuclear-weapon States Party to the Treaty on a non-discriminatory basis and that the charge to such Parties for the explosive devices used should be as low as possible and exclude any charge for research and development.

The Conference notes that any potential benefits could be made available to non-nuclear-weapon States not Party to the Treaty by way of nuclear explosion services provided by nuclear-weapon States, as defined by the Treaty, and conducted under the appropriate international observation and international procedures called for in Article V and in accordance with other applicable international obligations. The Conference considers it imperative that access to potential benefits of nuclear explosions for peaceful purposes not lead to any proliferation of nuclear explosive capability.

The Conference considers the IAEA to be the appropriate international body, referred to in Article V of the Treaty, through which potential benefits from peaceful applications of nuclear explosions could be made available to any non-nuclear-weapon State. Accordingly, the Conference urges the IAEA to expedite work on identifying and examining the important legal issues involved in, and to commence consideration of, the structure and content of the special international agreement or agreements contemplated in Article V of the Treaty, taking into account the views of the Conference of the Committee on Disarmament (CCD) and the United Nations General Assembly and enabling States Party to the Treaty but not Members of the IAEA which would wish to do so to participate in such work.

The Conference notes that the technology of nuclear explosions for peaceful purposes is still at the stage of development and study and that there are a number of interrelated international legal and other aspects of such explosions which still need to be investigated.

The Conference commends the work in this field that has been carried out within the IAEA and looks forward to the continuance of such work pursuant to United Nations General Assembly resolution 3261 D (XXIX). It emphasizes that the IAEA should play the central role in matters relating to the provision of services for the application of nuclear explosions for peaceful purposes. It believes that the IAEA should broaden its consideration of this subject to encompass, within its area of competence, all aspects and implications of the practical applications of nuclear explosions for peaceful purposes. To this end it urges the IAEA to set up appropriate machinery within which intergovernmental discussion can take place and through which advice can be given on the Agency's work in this field.

The Conference attaches considerable importance to the consideration by the CCD, pursuant to United Nations General Assembly resolution 3261 D (XXIX) and taking due account of the views of the IAEA, of the arms control implications of nuclear explosions for peaceful purposes.

The Conference notes that the thirtieth session of the United Nations General Assembly will receive reports pursuant to United Nations General Assembly resolution 3261 D (XXIX) and will provide an opportunity for States to discuss questions related to the application of nuclear explosions for peaceful purposes. The Conference further notes that the results of discussion in the United Nations General Assembly at its thirtieth session will be available to be taken into account by the IAEA and the CCD for their further consideration.

REVIEW OF ARTICLE VI

The Conference recalls the provisions of Article VI of the Treaty under which all Parties undertook to pursue negotiations in good faith on effective measures relating

—to the cessation of the nuclear arms race at an early date and

—to nuclear disarmament and

—to a treaty on general and complete disarmament under strict and effective international control.

While welcoming the various agreements on arms limitation and disarmament elaborated and concluded over the last few years as steps contributing to the implementation of Article VI of the Treaty, the Conference expresses its serious concern that the arms race, in particular the nuclear arms race, is continuing unabated.

The Conference therefore urges constant and resolute efforts by each of the Parties to the Treaty, in particular by the nuclear-weapon States, to achieve an early and effective implementation of Article VI of the Treaty.

The Conference affirms the determination expressed in the preamble to the 1963 Partial Test Ban Treaty and reiterated in the preamble to the Non-Proliferation Treaty to achieve the discontinuance of all test explosions of nuclear weapons for all time. The Conference expresses the view that the conclusion of a treaty banning all nuclear weapons tests is one of the most important measures to halt the nuclear arms race. It expresses the hope that the nuclear-weapon States Party to the Treaty will take the lead in reaching an early solution of the technical and political difficulties on this issue. It appeals to these States to make every effort to reach agreement on the conclusion of an effective comprehensive test ban. To this end the desire was expressed by a considerable number of delegations at the Conference that the nuclear-weapon States Party to the Treaty should as soon as possible enter into an agreement, open to all States and containing appropriate provisions to ensure its effectiveness, to halt all nuclear weapons tests of adhering States for a specified time, whereupon the terms of such an agreement would be reviewed in the light of the opportunity, at that time, to achieve a universal and permanent cessation of all nuclear weapons tests. The Conference calls upon the nuclear-weapon States signatories of the Treaty on the Limitation of Underground Nuclear Weapons Tests, meanwhile, to limit the number of their underground nuclear weapons tests to a minimum. The Conference believes that such steps would constitute an incentive of particular value to negotiations for the conclusion of a treaty banning all nuclear weapons test explosions for all time.

The Conference appeals to the nuclear-weapon States parties to the negotiations on the limitation of strategic arms to endeavour to conclude at the earliest possible date the new agreement that was outlined by their leaders in November 1974. The Conference looks forward to the commencement of follow-on negotiations on further limitations of, and significant reductions in, their nuclear weapons systems as soon as possible following the conclusion of such an agreement.

The Conference notes that, notwithstanding earlier progress, the CCD has recently been unable to reach agreement on new substantive measures to advance the objectives of Article VI of the Treaty. It urges, therefore, all members of the CCD Party to the Treaty, in particular the nuclear-weapon States Party, to increase their efforts to achieve effective disarmament agreements on all subjects on the agenda of the CCD.

The Conference expresses the hope that all States Party to the Treaty, through the United Nations and the CCD and other negotiations in which they participate, will work with determination towards the conclusion of arms limitation and disarmament agreements which will contribute to the goal of general and complete disarmament under strict and effective international control.

The Conference expresses the view that, disarmament being a matter of general concern, the provision of information to all governments and peoples on the situation in the field of the arms race and disarmament is of great importance for the attainment of the aims of Article VI. The Conference therefore invites the United Nations to consider ways and means of improving its existing facilities for the collection, compilation and dissemination of information on disarmament issues, in order to keep all governments as well as world public opinion properly informed on progress achieved in the realization of the provisions of Article VI of the Treaty.

REVIEW OF ARTICLE VII AND THE SECURITY OF NON-NUCLEAR WEAPON STATES

Recognizing that all States have need to ensure their independence, territorial integrity and sovereignty, the Conference emphasizes the particular importance of assuring and strengthening the security of non-nuclear-weapon States Parties which have renounced the acquisition of nuclear weapons. It acknowledges that States Parties find themselves in different security situations and therefore that various appropriate means are necessary to meet the security concerns of States Parties.

The Conference underlines the importance of adherence to the Treaty by non-nuclear-weapon States as the best means of reassuring one another of their renunciation of nuclear weapons and as one of the effective means of strengthening their mutual security.

The Conference takes note of the continued determination of the Depositary States to honour their statements, which were welcomed by the United Nations Security Council in resolution 255(1968), that, to ensure the security of the non-nuclear-weapon States Party to the Treaty, they will provide or support immediate assistance, in accordance with the Charter, to any non-nuclear-weapon State Party to the Treaty which is a victim of an act or an object of a threat of aggression in which nuclear weapons are used.

The Conference, bearing in mind Article VII of the Treaty, considers that the establishment of internationally recognized nuclear-weapon-free zones on the initiative and with the agreement of the directly concerned States of the zone, represents an effective means of curbing the spread of nuclear weapons, and could contribute significantly to the security of those States. It welcomes the steps which have been taken toward the establishment of such zones.

The Conference recognizes that for the maximum effectiveness of any Treaty arrangements for establishing a nuclear-weapon-free zone the co-operation of the nuclear-weapon States is necessary. At the Conference it was urged by a considerable number of delegations that nuclear-weapon States should provide, in an appropriate manner, binding security assurances to those States which become fully bound by the provisions of such regional arrangements.

At the Conference it was also urged that determined efforts must be made especially by the nuclear weapon States Party to the Treaty, to ensure the security of all non-nuclear-weapon States Parties. To this end the Conference urges all States, both nuclear-weapon States and non-nuclear-weapon States to refrain, in accordance with the Charter of the United Nations, from the threat or the use of force in relations between States, involving either nuclear or non-nuclear weapons. Additionally, it stresses the responsibility of all Parties to the Treaty and especially the nuclear-weapon States, to take effective steps to strengthen the security of non-nuclear-weapon States and to promote in all appropriate fora the consideration of all practical means to this end, taking into account the views expressed at this Conference.

REVIEW OF ARTICLE VIII

The Conference invites States Party to the Treaty which are Members of the United Nations to request the Secretary-General of the United Nations to include the following item in the provisional agenda of the thirty-first session of the General Assembly: "Implementation of the conclusions of the first Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons".

The States Party to the Treaty participating in the Conference propose to the Depositary Governments that a second Conference to review the operation of the Treaty be convened in 1980.

The Conference accordingly invites States Party to the Treaty which are Members of the United Nations to request the Secretary-General of the United Nations to include the following item in the provisional agenda of the thirty-third session of the General Assembly: "Implementation of the conclusions of the first Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons and establishment of a preparatory committee for the second Conference."

REVIEW OF ARTICLE IX

The five years that have passed since the entry into force of the Treaty have demonstrated its wide international acceptance. The Conference welcomes the recent progress towards achieving wider adherence. At the same time, the Conference notes with concern that the Treaty has not as yet achieved universal adherence. Therefore, the Conference expresses the hope that States that have not already joined the Treaty should do so at the earliest possible date.

UNOFFICIAL PAPER DISTRIBUTED AT FINAL
SESSION OF 1980 NPT REVIEW CONFERENCE*

Article III

1. The Conference expresses the conviction that IAEA safeguards play a key role in preventing proliferation of nuclear weapons or other explosive devices by way of deterring diversion of nuclear materials from peaceful activities to explosive purposes through the risk of early detection and will thereby contribute to promoting further confidence among States.

2. The Conference notes with satisfaction that as a result of its verification activities, the Agency has not detected any diversions, anomalies or misuses of safeguarded material to nuclear weapons or other nuclear explosive devices.

3. The Conference considers that the undertaking under Article III (1) to verify commitments under the Treaty of NNWSP is fully met by the conclusion and implementation of agreements in accordance with IAEA document INFCIRC 153. The Conference notes with satisfaction the conclusion of an increasing number of these safeguards agreements in compliance with the undertaking in Article III.1 of the Treaty. The Conference urges the non-nuclear weapon States Parties to the Treaty that have not concluded the agreements required under Article III (4) to conclude such agreements with the IAEA as soon as possible.

4. The Conference attaches great importance to the continued application of safeguards in accordance with Article III (1) on a non-discriminatory basis for the equal benefit of all States Parties to the Treaty.

5. The Conference considers that in the application of safeguards the IAEA should accord any non-nuclear-weapon State Party to the Treaty treatment with respect to safeguards not less favorable than the treatment [illegible] accords to other States or a group of States, provided that the Agency is satisfied that the national system of such a State achieves and maintains a degree of functional independence and technical effectiveness equivalent to that of such other States or groups of States. The Conference regards such a development as a measure to facilitate and complement the safeguards activities of the IAEA.

6. The Conference believes that all non-nuclear-weapon States not Parties to the Treaty should submit all their source or special fissionable material in all their nuclear activities to IAEA safeguards, with a view to preventing diversion of nuclear material to nuclear weapons or other nuclear explosive devices, and appeals to such States to do so.

7. [The Conference urges that States Parties to the Treaty participate acitvely in joint efforts with States concerned to adopt as a common requirement for the international exchange of nuclear materials and equipment, that non-nuclear-weapon States not Party to the Treaty accept the same safeguards obligations as have been accepted by non-nuclear-weapon States Parties to the Treaty.]

8. The Conference calls upon the parties to work actively towards this end, including by participation in the forthcoming meetings of the IAEA Committee on Assurances of Supply.

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*Circulated on the final day of the 1980 Review Conference. The document was drafted too late to be officially approved by the Conference.

9. [The Conference calls upon all nuclear-weapon States as well as non-nuclear-weapon States concerned, to cease all co-operation and to cut off supplies to Israel and South Africa, unless these countries submit all their nuclear programmes to IAEA full-scope safeguards, in order to prevent contributing further to these countries' capability to acquire or manufacture nuclear weapons or nuclear explosive devices.]

10. The Conference notes that the safeguards activities of the IAEA under Article III of the Treaty continue to respect the sovereign rights of States, that there are no indications that IAEA safeguards have hampered the economic, scientific or technological development of the Parties to the Treaty or international co-operation in peaceful nuclear activities, and that they contribute to the maintenance of confidence between States. It urges that this situation be maintained and that in further developing the Agency's safeguards activities, the promotion of the peaceful uses of nuclear energy should be fully taken into account.

11. The Conference, noting that existing IAEA safeguards approaches are capable of adequately dealing with current facility types, emphasizes the importance of continued improvements in the effectiveness and efficiency of IAEA safeguards. The Agency's responsibilities in the future can be expected to grow, inter alia, from the increasing amounts of nculear material and the increasing number and complexity of facilities. The Conference calls for the continuing support of States Parties for the IAEA safeguards system.

12. The Conference calls upon States Parties to take IAEA safeguards requirements fully into account in planning, designing and developing nuclear fuel cycle facilities.

13. The Conference notes that more regard needs to be paid to the importnce of recruiting and training staff for the safeguards activities of the Agency on as wide a geographical basis as possible in accordance with Article VIID of the Statute of the IAEA and the recommendation of the First Review Conference. It calls upon States to exercise the right of accepting or rejecting proposals for the designation of particualr IAEA inspectors in such a way as to facilitate the effective implementation of safeguards.

14. The Conference recommends that during the review of the arrangements relating to the financing of safeguards in the IAEA which is to be undertaken by the Board of Governors at an appropriate time in 1983 the less favorable financial situation of the developing countries be fully taken into account.

15. The Conference welcomes the opening for signature of the Convention on the Physical Protection of Nuclear Material, which has been negotiated under the auspices of the IAEA in fulfillment of the recommendations of the First Review Conference. The Conference urges all States that have not done so to become party, as soon as possible, to this Convention.

16. [The Conference expresses concern on the reports alleging that significant quantities of special nuclear material are unaccounted for in a nuclear-weapon State Party to the Treaty.]

17. The Conference in its review of Articles III and IV welcomes the work of the IAEA expert group on international plutonium storage, and supports efforts directed at the early establishment of an internationally agreed effective scheme for international plutonium storage on the basis of Article XII A5 of the IAEA Statute. The Conference considers that such a scheme for excess plutonium, if well designed, should not jeopardize the promotion of peaceful uses of nuclear energy, and would make a substantial contribution to non-proliferation as well as to the improvement of the assurance of nuclear supply and the development of common approaches and generally agreed arrangements for international nuclear trade. In addition, the Conference considers that such a scheme should not affect the free technological development of the countries concerned and the disposal of plutonium in accordance with internationally adopted arrangements, including the application of IAEA safeguards.

Article IV

1. The Conference reemphasizes its conviction that nothing in the Treaty shall be interpreted as affecting the inalienable right of all the Parties to the Treaty to develop research, production and use of nuclear energy for peaceful purposes without discrimination and in conformity with Article I and II of this Treaty.

2. The Conference urges further efforts to ensure that the benefits of peaceful applications of nuclear energy are made available to all Parties to the Treaty. In this context it recognises the growing needs of developing States and calls for continued and substantively increased assistance to such States through bilateral and multilateral channels such as the IAEA and the UNDP.

3. The Conference is of the view that the activities of the IAEA directed towards the broadening of world-wide cooperation in the field of the peaceful uses of nuclear energy are of central importance.

4. The Conference confirms that each country's choices and decisions in the field of peaceful uses of nuclear energy should be respected without jeopardizing their respective fuel cycle policies or international cooperation agreements and contracts for peaceful uses of nuclear energy, provided that agreed safeguards measures are applied.

5. The Conference notes that there has been continued growth in the use of nuclear energy for peaceful purposes amont Parties since the 1975 Review Conference.

6. The Conference notes the concern of many countries that, after the First Review Conference of Parties to the Treaty, a group of countries in closed consultations between themselves on nuclear supply conditions adopted and applied, including amongst themselves, common guidelines for the export of nuclear material, equipment and technology (INFIRC/254). While largely designed to broaden safeguards coverage in non-Parties to the NPT, these guidelines also called for "restraint in the transfer of sensitive facilities, technology and weapons-usable materials" which may also apply to non-nuclear weapons States Party to the Treaty. In addition, some countries have decided to introduce in their bilateral arrangements more stringent non-proliferation requirements beyond the provisions of Article III of the Treaty. In a few cases these had retroactive effect. Also, in a few cases there have been instances of delays and added costs with adverse consequences for economic planning and development of the importing States. Non-adherence to the Treaty by a number of countries with nuclear programmes and the explosion of a nuclear deivce by an additional State were seen by these supplier countries as important reasons when they sought agreement on the guidelines and modified export requirements. These motivations, however, had not been shared by some importing countries, which have undertaken full-scope safeguards.

7. States participating in the Conference, while reaffirming their adherence to the principle of non-proliferation, note that the introduction unilaterally of supply conditions without consultation among the Parties has been a cause of concern. The Conference notes the view of some importing States that the application of measures of control and supervision beyond the IAEA safeguards under Article III as a condition of international nuclear cooperation does not allow the full implementation of Article IV of the Treaty. However, States applying such measures do not share this view. The Conference considers that the introduction of new non-proliferation measures should be the subject of consultation and the broadest possible consensus among the Parties to the Treaty, inter alia, through the IAEA.

8. States Parties propose to meet annually in Vienna at the Headquarters of the IAEA to discuss the implementation of Article IV in the context also of Article III of the Treaty. In this connection, the Parties will request the IAEA to make the necessary arrangements.

9. The Conference welcomes the establishment of an IAEA Committee on Assurances of Supply to consider and advise the Board of Governors on ways and means in which supplies of nuclear material equipment and technology and fuel cycle services can be assured on a more predictable and long-term basis in accordance with mutually acceptable considerations of non-proliferation and the Agency's role and responsibilities in relation thereto.

10. The Conference stresses the importance of using the Committee on Assurances of Supply to develop as wide a consensus as possible and urges States Parties to the Treaty to give their full support towards the early attainment of the objectives of the Committee on Assurances of Supply.

11. The Conference requests States Parties to consider and make recommendations where appropriate, within the framework of the Committee on Assurances of Supply and other relevant fora on proposed institutional arrangements ranging from multinational ventures to regional fuel cycle centres and to continue the consideration begun in INFCE of suitable emergency backup mechanisms including a uranium emergency safety network and an international nuclear fuel bank.

12. The Conference considers that international agreements on the peaceful uses of nuclear energy amongst States Party to the Treaty should be fulfilled in accordance with international law and with a view also to facilitating the fulfillment of contracts. The Conference urges that, in adopting relevant national legislation and regulations, States Parties to the Treaty take fully into account, by consultations or otherwise, the obligations, rights and mutual responsibilities contained in the Treaty and in their nuclear agreements, as required by principles of international law.

13. The Conference affirms that where one or other party to a bilateral agreement wishes to seek the renegotiation of non-proliferation conditions, it is desirable that means be devised to achieve such renegotiaton equitably, without resort to the unilateral interruption of supply or import, or the threat of such interruption, and with each party avoiding to the extent possible the unilateral imposition of additional costs on the other or of new conditions retroactively applied.

14. The Conference confirms the significance of peaceful uses of nuclear energy for economic development and the important contribution it can make in accelerating the economic growth of developing countries and overcoming the technological and economic disparities among States.

15. The Conference recognises that due to their weaker infrastructure and financial base, the developing countries are more vulnerable to changing conditions. The Conference therefore considers that effective measures can and should be taken to meet the specific needs of developing countries in the peaceful uses of nuclear energy.

16. The Conference suggests the continuation of the study of financing the technical assistance programme of the IAEA in accordance with the decision taken by the last General Conference of the IAEA.

17. The Conference calls further on all States Party to the Treaty in a postion to so to meet the "technically sound" requests for technical assistnace submitted by developing States Party to the Treaty that the IAEA is unable to finance form its own resources as well as such "technically sound" requests as may be made by developing States Party to the Treaty which are not members of the IAEA.

18. The Conference calls on States Parties to the Treaty to give consideration to the establishment on the basis of voluntary contributions of a Special Fund to be administered by the IAEA, or otherwise provide special contributions for the provision of technical assistance to developing non-nuclear-weapon States Parties to the Treaty in order to encourage and assist research in, and development and practical application of, nuclear energy for peaceful purposes. The Fund could be utilised to contribute to research reactor programmes.

19. The non-nuclear-weapon States Parties to the Treaty and those States that have safeguards commitments equal to those required under Article III.1 of the Treaty should be provided preferential treatment in access to or transfer of equipment, materials, services and scientific and technological information for the peaceful uses of nuclear energy, taking particularly into account needs of developing countries.

20. States Parties to the Treaty should promote the establishment of more favorable conditions in national, regional and international financial institutions for the financing of nuclear energy projects in developing countries.

21. The Conference notes with satisfaction the technical study by the International Nuclear Fuel Cycle Evaluation (INFCE) as an importnat exercise in the search for ways of making nuclear energy widely available consistent with non-proliferation.

22. The Conference notes that energy backup mechanisms such as a urnaium emergency safety network or an international nuclear fuel bank are to be considered. As an interim measure, the Conference calls on States Parties in a position to do so (including particularly one or more Depositaries) to make available, on a commercial basis, an interim uranium stockpile sufficient for one annual LWR reload of enriched uranium and one annual LWR reload of natural uranium together with specific arrangements and conditions under which this uranium would be available to Parties which are unable to secure fuel supplied under existing contracts for reasons of contract default that were not the result of a breach of the non-proliferation undertakings stipulated in the relevant agreement.

23. The Conference notes there is a growing need for storage of spent nuclear fuel and therefore welcomes the ongoing studies in the IAEA concerning the management of spent nuclear fuel.

24. The Conference calls on all Parties to give serious consideration to the establishment of international nuclear fuel cycle facilities, including multinational participation on a sound economic basis.

25. The Conference also recommends that the IAEA extend its outdy to cover the whole of the nuclear fule cycle, in accordance with the recommendations made by the First Review Conference.

26. The Conference expects that the convening of the International Conference for the promotion of international cooperation in the peaceful uses of nuclear energy, decided by the United Nations General Assembly resolution 34/63, bearing in mind the terms of the United Nations General Assembly resolution 32/50, will be of importance to the nuclear cooperation matters addressed by the Conference.

Article V

1. The Conference reaffirms the obligation of Parties to the Treaty to take appropriate measures to ensure that potential benefits from any peaceful application of nuclear explosions are made available to non-nuclear-weapon States which are Party to the Treaty in accordance with the provisions of Article V of the Treaty and other relevant international obligations.

2. The Conference confirms that the IAEA is the appropriate international body through which any potential benefits of peaceful nuclear explosions could be made available to non-nuclear-weapon States under the terms of Article V of the Treaty.

3. The Conference notes that the IAEA has received no information in the past few years from the nuclear-weapon States and urges the IAEA to regularly include in its annual reports for the information of all States Parties to the Treaty, pursuant to its central role in arrangements for peaceful applications of nuclear explosions, a listing of all reports and information regarding the development of peaceful applications of nuclear explosions received from nuclear-weapon States during the period under review. The Conference calls on the nuclear-weapon States Parties to the Treaty to continue to provide the Agency with any such information which may become available to them. The Conference further urges the IAEA to continue to submit to the United Nations General Assembly information on the peaceful uses of nuclear explosions and on the prospects for their use.

4. The Conference supports the work of the IAEA Procedures Group and notes that existing procedures have been adequate to deal with requests which have been made so far to the IAEA for assistance in this area and that the special machinery called for at the First Review Conference has yet to be formed.

5. The Conference notes the extensive work of the Ad Hoc Advisory Group on Nuclear Explosions set up by the IAEA in accordance with the requirements of the terms of the Treaty and commends its report which was adopted by consensus and noted with appreciation by the IAEA Board of Governors and subsequently forwarded to the Secretary-General of the United Nations [in 1977]. The Conference notes that the IAEA Board of Governors decided to keep the matter of peaceful uses of nuclear explosions under review.

6. The Conference further notes that peaceful uses of nuclear explosions are at an early stage of development and no application has reached the stage at which projects can be subjected to the economic assessment judged appropriate by the Ad Hoc Advisory Group. The Conference notes that potential benefits from peaceful applications of nuclear explosions have not been demonstrated.

Issue Brief

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NUCLEAR NON-PROLIFERATION TREATY CONFERENCE OF 1985

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ISSUE DEFINITION

In September 1985, the United States will take part in the third international review conference for the Treaty on the Non-Proliferation of Nuclear Weapons (NPT). The NPT is the cornerstone of an international collection, or regime, of treaties, agreements, voluntary commitments and understandings intended to prevent the spread, or proliferation, of nuclear weapons. The outcome of this conference is sure to affect the continued participation of some members in the NPT and is likely to have an impact on U.S. nonproliferation policies. Of particular interest is the potential impact of another impasse in the review conference, particularly since the Treaty is up for a 25-year review in 1995. At issue for Congress is its oversight function in assessing U.S. preparations for the conference and how it should appraise conference results.

(This issue brief was prepared for CRS by Dr. Robert L. Beckman under supervision of Senior Specialist, Dr. Warren H. Donnelly. Dr. Beckman is now on the faculty of the U.S. Naval Academy. Questions about the brief or its subject should be addressed to Dr. Donnelly.)

BACKGROUND AND POLICY ANALYSIS

History of the Nuclear Non-Proliferation Treaty

The development of the atomic bomb during World War II introduced two problems which continue to the present day: the urgent need to prevent the spread, or proliferation, of nuclear weapons into the hands of additional countries; and the possibility that some countries might try to divert certain kinds of nuclear fuels from peaceful uses to produce nuclear weapons.

The United States has been the world leader in the attempt to prevent the further spread of nuclear weapons. At the same time, it has become U.S. strategic defense policy to depend upon an arsenal of atomic weapons for national security. After the Atoms for Peace speech of President Eisenhower on Dec. 8, 1953, it also became United States policy to encourage and assist peaceful uses of nuclear energy under international inspection.

Thus, since the mid-1950s the United States has been pursuing policies which some see as contradictory, seeking simultaneously to maintain a nuclear arsenal for national defense; work toward nuclear disarmament; assist in the worldwide development of the peaceful uses of nuclear energy; and establish an international regime to deter the diversion of nuclear fuels from peaceful to malevolent purposes.

Beginning in 1959, the United States entered into a series of four arms control agreements intended to control the spread of nuclear weapons. By the mid-1960s discussions were underway in the United Nations to articulate general principles to guide negotiations for a non-proliferation treaty. Five agreed upon principles were:

1. The treaty should be void of any loop-holes which might
   permit nuclear or non-nuclear powers to proliferate,
   directly or indirectly, nuclear weapons in any form.

2. The treaty should embody an acceptable balance of mutual responsibilities and obligations of the nuclear and non-nuclear powers.

3. The treaty should be a step towards the achievement of general and complete disarmament and, more particularly, nuclear disarmament.

4. There should be acceptable and workable provisions to ensure the effectiveness of the treaty.

5. Nothing in the treaty should adversely affect the right of any group of States to conclude regional treaties in order to ensure the total absence of nuclear weapons in their respective territories.

Discussions between the United States and the Soviet Union throughout the 1960s sought to control the spread of nuclear weapons to additional countries. Progress was slowed by disagreements over the amount of nuclear sharing between the United States and West Germany and over verification procedures to ensure that member states were abiding by their commitments made in the treaty.

On Aug. 24, 1967, the United States and the Soviet Union submitted identical draft treaties to the United Nations Eighteen Nation Disarmament Committee (ENDC). The drafts in essence had been negotiated in private. Not until 1968 did any language on reciprocal agreements about ending vertical proliferation enter into the Treaty. In Article VI of the proposed NPT, all parties pledged themselves "to pursue negotiations in good faith on effective measures relating to cessation of the nuclear arms race at an early date and to nuclear disarmament ...." President Johnson explained the reciprocal promises made by the superpowers:

> The non-nuclear states have wanted their renunciation of nuclear weapons to be matched with a binding pledge by the nuclear powers to negotiate a halt in the arms race ... they have asked us to pledge ourselves to move towards that ultimate goal. They feel the restraints they will voluntarily accept give them the right to such a pledge.... [The U.S. and the Soviet Union] have jointly pledged our nations to negotiate towards the cessation of the nuclear arms race .... The obligations of the non-proliferation treaty will reinforce our will to bring an end to the nuclear arms race. The world will judge us by our performance.

On June 12, 1968, a resolution in the General Assembly of the United Nations commended the treaty and on July 1, 1968, 62 nations -- including the United States, the United Kingdom, and the Soviet Union -- signed it.

The treaty is a brief document which pledges members to help prevent the horizontal dissemination of nuclear weapons, to work toward ending the nuclear arms race, and toward general and complete disarmament. As well, the preamble and 11 articles established the principle that member states were entitled to the benefits of peaceful applications of nuclear technology under appropriate international safeguards.

President Johnson sent the treaty to Congress on July 9, 1968, and the Senate Committee on Foreign Relations opened hearings on it the next day. Though the Committee voted to recommend it, Congress adjourned for the Presidential campaign. Incoming President Nixon re-endorsed the treaty in a special message to the Senate on Feb. 5, 1969. After further hearings by the Senate Committee on Foreign Relations, the Senate approved the treaty on Mar. 13, 1969, and it entered into force on Mar. 5, 1970.

Today there are 124 nations party to the NPT. These do not include two nuclear weapons states, China and France, and a number of other states likely to use nuclear power for peaceful purposes or liable to be interested in nuclear weapons. The list of nonsignatories includes Argentina, Brazil, Cuba, India, Israel, North Korea, Pakistan, South Africa, and Spain. France, though refusing to sign the NPT, has said that it would act as though it had.

Provisions for Review

Article VIII of the NPT provides for a conference, 5 years after the Treaty entered into force, to review the operation of the Treaty and to assure that the purposes stated in the preamble and the body of the Treaty were being realized. It also provided that further conferences could be convened at intervals of 5 years if a majority of the parties so proposed. The first of those conferences was held in Geneva in May 1975. The second conference, also in Geneva, occurred in August and September 1980. The third conference is scheduled in Geneva for September 1985.

The 1975 and 1980 Review Conferences

Preparatory Meetings: Preparations for the first two review conferences began at the United Nations with General Assembly resolutions expressing the hope that review conferences would take place. Preliminary conference details were arranged in three pre- conference sessions. Member countries on the Board of Governors of the IAEA or represented at the United Nations Conference of the Committee on Disarmament (renamed the Committee on Disarmament in 1979) were eligible to participate in the preparations. In 1975, 33 nations participated in the preliminary discussions; in 1980, 43 nations.

Organization and Work of the Conferences: The rules of procedure for each conference established two main committees to review the operations of the Treaty and to prepare drafts for the final document. Committee I reviewed political aspects of the Treaty and suggested measures that would lead to its acceptance by more nations, and implementation of the provisions of the Treaty relating to non-proliferation of nuclear weapons, disarmament and international peace and security. Committee II reviewed provisions of the Treaty relating to peaceful applications of nuclear energy.

Outcome of the conferences: Neither conference went smoothly. Fundamental differences between the nuclear-weapons states and non-nuclear-weapons states made it difficult to arrive at a consensus final document at each conference.

Positions of the Nuclear-Weapons States: At each conference, the NWS concentrated on technical aspects of limiting proliferation, which included safeguards, nuclear export policies, physical security, and multinational or regional nuclear fuel centers. The NWS emphasized the importance of the Treaty and stressed the progress made toward halting proliferation since 1970 and the cooperation by both NNWS and NWS in fulfilling their obligations under the NPT. At each conference, the NWS recalled the importance of continued adherence to the Treaty by members and the need for enlarging membership in the NPT.

Views of the Non-Nuclear-Weapons States: The NNWS consisted of three groups: the industrial countries of Europe plus Japan; the Eastern, or Soviet, group; and the nations of the "Third World," also known as the "Group of 77" countries. (The Group is a loose coalition of developing countries which includes over two-thirds of NPT members. Its members are active in the non-aligned movement as well.) The biggest issues raised by NNWS dealt with Article VI and included strategic arms limitations, a comprehensive test ban, and security guarantees from NWS. In both conferences, the "G77" states raised continuous complaints about alleged NWS non-compliance with the arms control commitments of Article VI.

In 1975, Conference President Thoreson of Sweden summarized the major complaints, saying:

> It seems to me that an enlightened world opinion,
> reflected in this case, in statements by non-nuclear-weapons
> states, rather impatiently awaits concrete and binding
> results of on-going bilateral negotiations, aiming at
> ending the quantitative and qualitative arms race, and
> reducing substantially the levels of nuclear armaments.
> Many have referred to the need for a time-table for
> results to be achieved through these negotiations.
> The agreement on a comprehensive test ban is clearly
> recognized as a most decisive element in these efforts.
> A least common denominator is apparent in the statements:
> Article VI must be implemented, in letter and in spirit.

Similar complaints were voiced in 1980. Perhaps because the Group of 77 sensed so little progress between 1975 and 1980, the conferences ended quite differently.

The Final Declaration of 1975: The 1975 conference deadlocked because neither the NWS and their allies nor the Group of 77 could command the 2/3 majority vote to make final decisions. Through the force of her personality, and the willingness of several holdout states to accede to the general will of the 1975 conference, President Thoreson was able to break the impasse with a watered- down draft of a final declaration which was finally adopted on the last day of the conference.

The final declaration stressed a strong interest of NPT states in averting further proliferation, their strong support for the Treaty, and their commitment to implement fully and more effectively its provisions. The Declaration also reaffirmed the vital role of the Treaty in international efforts to avert further proliferation, end the nuclear arms race, move toward nuclear disarmament, and promote cooperation in the peaceful uses of nuclear energy under adequate safeguards. To date, of the 24 recommendations contained in the Final Declaration, less than half have been acted upon.

The Impasse of 1980: No substantive consensus document emerged from the 1980 conference. The Group of 77 decided that it would rather have the conference end in disarray than agree to what they regarded as a "phony" consensus. The Group wanted a timetable for reducing nuclear arms; to this the United States and the Soviet Union would not agree. Even though there was substantial agreement about the peaceful uses of nuclear energy, the Group of 77 used obstructionism in the final hours of the conference -- which was even extended 2 days in the search for a consensus -- to exact concessions from the NWS and to shock the superpowers into reexamining their disarmament policies. In the end, the NWS and their allies maintained that the NPT review process was not the proper forum to negotiate arms control agreements.

Alan Geyer, an observer for non-governmental organizations present at the 1980 conference, echoed remarks heard from the more vocal of the non-aligned NNWS over the years:

> ... states that have renounced nuclear weapons for themselves under the [NPT] regard Article VI as the basic quid pro quo under international law, without which the treaty would lose its legitimacy. It is also quite clear that the continuing violations of Article VI by the superpowers provide nonparties with all the moral warrant they need to remain outsiders to the treaty and its obligations, whatever the real motive.

The Third NPT Review Conference

Preparations for the Conference: The Third NPT Review Conference is scheduled to be held in Geneva in September 1985. The first meeting of its Preparatory Committee was held in Geneva in April 1984 and a second in October. The third and last is scheduled for April 1985. Unlike past Preparatory Committees in which participation was limited to parties to the NPT who also served on the Board of Governors of the IAEA or on the Committee on Disarmament, the Committee for the 1985 conference is open to all NPT parties.

Heading the U.S. delegation to 1985 Preparatory Committees is Dr. Lewis Dunn, the Assistant Director for Non-Proliferation, Arms Control and Disarmament Agency (ACDA). According to ACDA, the United States has been working since 1982 with many NPT parties to strengthen a consensus on the continued vitality of the Treaty. Though the United States probably will not aim for a consensus document to end the conference, it will stress the need to strengthen the NPT regime. This strategy would point to the convergence of views on nonproliferation since the NPT was signed; the spirit of cooperation on peaceful nuclear energy uses; steps to promote additional adherence to the Treaty among the approximately 45 hold-out countries; emphasizing the NPT's critical role as the linchpin in the nonproliferation regime; and stressing the NPT as a confidence-building measure, without which trust might dissolve. In October 1984, Mohamed I Shaker, Egyptian Deputy Permanent Representative to the United Nations, was named President of the 1985 NPT Review Conference. Only 4 months earlier, Ambassador Shaker indicated what he believed would be the focus of the 1985 review:

> I am not so much worried about issues of nuclear supply as I am worried about disarmament.... I am not underestimating the difficulties concerning nuclear supply at the Conference but I believe we

> can build up on that fragile consensus and start from where we left in 1980. My real worry is nuclear disarmament... we must guard against another failure to reach consensus at the forthcoming NPT Review Conference. It may be serious this time. I do not think we can rely indefinitely on a continuous increase in adherence to the NPT. I would even say we cannot be sure this time that there will be no defections.

Preliminary indications are that many NNWS intend to use the 1985 review conference to discuss arms control issues, and especially to press the NWS to comply with the reciprocal promises made in Article VI. The United States, Great Britain, and the Soviet Union are anxious to avoid such confrontations because it might undermine the continuing successes of the NPT. Thus, their preparations include efforts to coordinate their own strategies at the conference and to work with moderates among non-aligned states who would be willing to join in a declaration that the world is better off with the NPT than without it.

Significant Developments Likely to Affect the 1985 NPT Review Conference

World events since the 1980 NPT review conference are likely to affect the climate of the 1985 conference and the proposals and issues that may be raised there. On the positive side, since the last review conference, no non-weapons state is known to have tested nuclear weapons, no state has withdrawn from the Treaty, and 10 more states have ratified it. There are, however, suspicions that certain non-NPT states may have interests in nuclear weapons.

Proliferation events since 1980 that could influence the 1985 conference include:

(1) declining forecasts for world nuclear power, which, to the extent that proliferation is linked to nuclear power, would imply declining risks of proliferation;

(2) suspicions that Pakistan, South Africa and other countries are trying to make nuclear weapons, and that Israel may already have them;

(3) President Reagan's break with the anti-plutonium policy of the Carter Administration, and the end to active U.S. discouragement of foreign reprocessing and use of plutonium in breeder reactors;

(4) the Israeli attack on Iraq's Osirak research reactor, with its implications for the necessity of improving international safeguards;

(5) conflicting signals from the United States demonstrating that political or national security concerns are sometimes viewed as more important than strict enforcement sanctions for behavior that contravenes U.S. non-proliferation policy;

(6) continued action in Congress to tighten U.S. nuclear export controls;

(7) work in the IAEA's Committee on Assurances of Supply (CAS) aimed at reducing the adverse impacts of governmental intervention on international

nuclear commerce;

(8) preparations for a 1986 United Nations Conference for the Promotion of International Cooperation in the peaceful Uses of Nuclear Energy (UNCPICPUNE);

(9) the lack of strategic and tactical nuclear weapons discussions between the United States and the Soviet Union. A continued hiatus is certain to provoke controversy on such arms control issues as arms buildups; U.S. unwillingness to ratify SALT II, or the Threshold Test Ban and Peaceful Nuclear Explosion Treaties; the suspension of talks on a Comprehensive Test Ban; and anti-satellite and space-based weapons;

(10) China's expanding peaceful nuclear role and the rise of second-tier suppliers, all of which threaten a potential degradation in the Nuclear Supplier Group's consensus on appropriate nuclear export behavior;

(11) the worldwide rise of peace and disarmament initiatives, such as the nuclear freeze and the Five Continent Peace Initiative, aimed at freezing the superpower nuclear arms buildups.

Other developments since 1980 which may influence the 1985 conference include

(1) the U.S.-Soviet tension over the military crackdown in Poland, the Soviet downing of Korean airliner 007, the continuing Soviet presence in Afghanistan, and continuing wars in the Middle East, Africa, and Central America;

(2) the December 1983 deployment of U.S. Pershing II and cruise missiles into the European theater;

(3) the Moscow visit of an IAEA team in May 1983 to negotiate an agreement for on-site inspection of selected civilian nuclear facilities;

(4) the November 1983 announcement by Argentina that it had secretly built a medium-sized uranium enrichment plant capable of producing quantities of uranium enriched to a grade suitable for use in nuclear weapons;

(5) continuing crises in the IAEA over accepting the credentials of Israel's delegations;

(6) continuing worldwide progress toward the day when plutonium will become a commercial commodity, coupled with the cancellation in 1983 of the U.S. Clinch River Breeder Reactor; and

(7) China's entry in 1983 into the IAEA.

(Detailed additional information about the history of the NPT and the 1975 and 1980 review conferences appears in a CRS report by Dr. Robert L. Beckman entitled The Treaty on the Non-Proliferation of Nuclear Weapons: The 1985 Review Conference and Matters for Congressional Concern.)

Congressional Oversight of the NPT Review Conferences

The first review conference in 1975 occurred without any congressional hearings. The only Member of Congress present at the Conference was Senator

Kennedy (D-MA), who addressed an informal meeting of conference delegates and unofficially sat in on some deliberations. Additionally, two professional staff members of the Senate Committee on Government Operations attended as unofficial observers.

Congressional oversight for the second review conference took the form of hearings by the House Committee on Foreign Affairs and the Senate Committee on Foreign Relations.

House Hearings: On July 16, 1979, the Subcommittees on International Security and Scientific Affairs and on International Economic Policy and Trade of the House Foreign Affairs Committee held a hearing on the second NPT review conference. Witnesses confirmed that troublesome issues likely to arise at the 1980 conference -- other than the repercussions from a U.S. failure to ratify SALT II or the Comprehensive Test Ban Treaty -- were those related to cooperation in nuclear energy and international control over nuclear exports. Spokesmen for the Carter Administration emphasized the great importance of the NPT to limit the further spread of nuclear weapons, the Administration's desire to have review conference support and to not weaken the non-nuclear weapons commitment of NNWS.

Senate Hearings: On July 24, 1980, the Subcommittee on Arms Control, Oceans, International Operations and Environment held a hearing on the 1980 conference. The sole witness, an Administration witness from ACDA, stated that the goal of the United States at the conference would be to demonstrate that the NPT serves as the essential framework for international nonproliferation efforts; to work toward attracting wider adherence to the NPT; to encourage the strengthening of IAEA safeguards; to explain U.S. nuclear export policies and the U.S. record of cooperation with NPT parties in the peaceful uses of nuclear energy; and to present an affirmative case regarding the U.S. record on arms control and security matters.

Interest for the 1985 Conference: Thus far, Congress has shown little interest in preparations for the 1985 review conference. It is understood that Members and staff of the foreign relations committees have been briefed by the Reagan Administration.

Several non-governmental organizations (NGOs) are trying to organize a unified approach to the conference. These NGOs, both domestic and international, represent anti-nuclear power and pro nuclear freeze constituencies, along with a wide array of nonproliferation and arms control and disarmament groups. They hope to influence Congress to hold hearings on superpower lack of compliance with Article VI provisions of the NPT and on alleged Administration loosening of U.S. nuclear export criteria.

POLICY ANALYSIS

Major Issues Facing Congress

Despite limited congressional attention to the 1985 NPT review conference, there are some issues that Congress may wish to consider in the months before the September 1985 conference. They include

(1) the options for congressional oversight on U.S. preparations for the conference and the uses to which results of the conference will be put specifically with regard to continuing briefings, congressional access to

background papers, and hearings;

(2) the benefits and the disadvantages of congressional participation in the conference;

(3) ways to conduct oversight without compromising U.S. positions at the conference;

(4) the state of U.S. preparations for participation in the conference with respect to

(a) likely criticisms of the superpowers for lack of progress in nuclear arms control;

(b) likely criticism of U.S. nonproliferation policies, particularly those that would prevent transfer of sensitive nuclear technologies (enrichment and reprocessing) to non-weapons members, and of unilateral and retroactive U.S. nonproliferation policy changes;

(c) ways to prevent the conference from weakening nonproliferation commitments and policies;

(d) prospects for getting important holdout states to ratify the NPT (Argentina, Brazil, Israel, India, South Africa, Spain, Pakistan), and additional incentives that could be offered to induce ratification;

(e) the effects of the U.S. position at the IAEA on Israel;

(f) ways to strengthen political and security reasons for states not to acquire nuclear weapons;

(g) the prospects that the United States could convince NNWS that the benefits of nuclear power can be had without national enrichment, reprocessing, and the use of plutonium as a fuel;

(h) ways in which the United States is helping NNWS to identify alternative options to nuclear power and to develop non-nuclear energy resources; and

(i) relation to ways to dispose of surplus nuclear weapons materials released by arms control agreements, and to verify that disposition.

(5) the possibility that there may not be the political will in 1985 to to work toward a consensus document and that the conference may break down without any success or noticeable progress on resolving Article VI charges; and

(6) the possibility that a breakdown in the 1985 review conference will lead to a consensus that a review conference in 1990 would be irrelevant or that a momentum might build against renewal of the NPT at the 25-year review in 1995.

in the NPT review conference. Representatives from thirty-five nations attended.

05/17/74 -- India exploded a "peaceful nuclear device".

05/26/72 -- The 1972 SALT ABM Treaty and the Interim Agreement were signed. They entered into force on October 3, 1972.

02/11/71 -- The Seabed Treaty was signed to prohibit the emplacement of nuclear weapons on the seabed beyond a 12-mile zone. It entered into force on May 18, 1972.

03/05/70 -- The Treaty on the Non-Proliferation of Nuclear Weapons (NPT) entered into force with deposit of U.S. ratification.

07/01/68 -- 62 nations, including the United States, United Kingdom, and the Soviet Union, signed the NPT.

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HEARINGS

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U.S. Congress. House. Committee on Foreign Affairs. Subcommittees on International Security and Scientific Affairs and on International Economic Policy and Trade. The Second Nuclear Non-Proliferation Review Conference: Implications of recent nuclear developments. Hearings, 96th Congress, 1st session. July 16, 1979. Washington, U.S. Govt. Print. Off., 1979. 51 p.

CHRONOLOGY OF EVENTS

09/00/85 -- The Third NPT Review Conference is scheduled to take

04/22/85-05/03/85 -- The third preparatory meeting of the 1985 NPT Review is scheduled to take place in Geneva.

10/01/84 -- The second preparatory meeting of the 1985 Review Conference took place.

07/00/84 -- 13 Western members of the Nuclear Suppliers Group agreed that full-scope safeguards should apply to all future nuclear exports.

05/22/84 -- The leaders of six nations on five continents issued a joint declaration declaration on controlling the nuclear arms race.

04/02/84 -- The first preparatory meeting of the Review Conference took place.

03/29/84 -- The Reagan Administration raised the possibility that it may cease observing previously agreed U.S.-Soviet strategic arms limitations at the end of 1985, depending on the international situation and on U.S. national security requirements.

01/00/84 -- China joined the IAEA.

12/08/83 -- The Soviet Union left the Strategic Arms Limitation Talks without setting a time for resumption of talks.

12/00/83 -- A U.N. General Assembly resolution noted that a preparatory committee was formed to prepare for the Third NPT Review Conference.

11/23/83 -- The USSR, citing the deployment of new nuclear weapons in Europe, broke off talks aimed at limiting intermediate range nuclear weapons.

11/18/83 -- Argentina announced that it had built a medium-sized uranium enrichment plant and pledged that it would be devoted to peaceful uses and not to produce material for nuclear weapons. The plant was not subject to IAEA safeguards.

10/26/83 -- The Senate, in acting on the Supplemental Appropriations, 1984, rejected an amendment to fund the Clinch River Breeder Reactor project by a vote of 56 to 40, effectively cancelling the CRBR.

05/00/83 -- An IAEA team visited Moscow to negotiate an agreement for on-site inspection of selected civilian nuclear facilities.

12/20/82 -- News reports that India's military leaders had a contingency plan for a preemptive strike against Pakistani nuclear facilities and proposed such an attack to Prime Minister Ghandi earlier in the year.

07/19/82 -- The United States was reported to have decided to break off talks on a comprehensive test ban with the U.S.S.R. and the United Kingdom.

12/15/81 -- By a vote of 55 yeas to 42 nays, the Senate approved a conference report on S. 1196, authorizing funds for FY82 for foreign assistance programs to Pakistan, among other countries.

11/27/81 -- NRC Chairman Palladino wrote to Senators Percy and Glenn expressing the Commission's concern that IAEA safeguards may be inadequate in some instances.

11/13/81 -- By a vote of 79-0, the Senate ratified Protocol I of the Treaty of Tlatelolco establishing a nuclear weapons-free zone in Latin America.

11/00/81 -- China announced that it entered the nuclear export market, saying that it would require peaceful use pledges.

07/16/81 -- President Reagan issued a statement which indicated some fundamental changes to U.S. nuclear nonproliferation policy.

06/07/81 -- Israel attacked and severely damaged the Iraqi research reactor near Baghdad.

12/05/80 -- The U.N. General Assembly passed a resolution calling for a peaceful nuclear uses conference. The 1986 conference will be called the U.N. Conference for the Promotion of International Cooperation in the Peaceful Uses of Nuclear Energy (UNCPICPUNE).

08/11/80 -- 09/05/80 -- The second NPT Review Conference took place in Geneva.

07/24/80 -- The Senate Committee on Foreign Relations held a hearing on the NPT review conference.

06/20/80 -- The IAEA Board of Governors established a Committee on Assurances of Supply (CAS).

01/03/80 -- President Carter requested that the Senate delay consideration of ratification of SALT II. Action was halted, never to restart.

12/25/79 -- The Soviet Union invaded Afghanistan.

09/22/79 -- A U.S. surveillance satellite detected a mysterious double-flash in the South Atlantic Ocean which was widely reported to have the characteristics of a nuclear explosion. The likely suspects are South Africa and Israel.

07/16/79 -- The House Committee on Foreign Affairs held a hearing on the NPT review conference.

06/18/79 -- President Carter and Soviet President Brezhnev signed the Treaty on the Limitation of Strategic Offensive Weapons (SALT II).

04/00/79 -- U.S. military and economic aid to Pakistan is cut off under terms of the Symington amendment to the Foreign Assistance Act because of U.S. fears about Pakistani efforts to build a nuclear weapon.

03/28/79 -- An accident occurred at the Three Mile Island nuclear power plant near Harrisburg, Pennsylvania.

05/23/78 - 06/30/78 -- The Tenth Special Session of the United Nations General Assembly on Disarmament in New York. Representatives of one hundred forty-five nations met to consider all aspects of disarmament. Some nonproliferation issues were discussed.

03/10/78 -- The Nuclear Non-Proliferation Act of 1978 (P.L. 95-242) was signed by President Carter.

01/16/78 -- The fifteen members of the Nuclear Suppliers' Group submitted to the IAEA an agreement on a common nuclear exports policy.

04/07/77 -- President Carter, in a major shift in U.S. nuclear energy policy, ended government support for the commercial reprocessing of spent fuel and use of plutonium in nuclear power.

05/05/75 - 05/30/75 -- The first NPT Review Conference took place in Geneva.

04/29/75 -- A conference of the United Nations Institute for Training and Research (UNITAR) was sponsored at U.N. headquarters to discuss problems facing participants